ECOSYSTEMS IMPROVED FOR SUSTAINABLE FISHERIES (ECOFISH) Project

YEAR 3 MONITORING REPORT

ECOFISH Document No.: 03/2016
Version: Final

Implemented with:
Department of Agriculture-Bureau of Fisheries and Aquatic Resources
National Government Agencies
Local Government Units
Assisting Organizations

Supported by:
United States Agency for International Development
Contract No.: AID-492-C-12-00008

Managed by:
Tetra Tech ARD

15 August 2016

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Abbreviations and Acronyms

BFAR	-	Bureau of Fisheries and Aquatic Resources
CIG	-	Calamianes Island Group
CPUE	-	Catch Per Unit Effort
CRM	-	Coastal Resources Management
CRMP	-	Coastal Resources Management Project
DA	-	Department of Agriculture
DB	-	Danajon Bank
DENR	-	Department of Environment and Natural Resources
EAFM	-	Ecosystem Approach to Fisheries Management
ECOFISH	-	Ecosystems Improved for Sustainable Fisheries
FGD	-	Focus Group Discussion
FISH	-	Fisheries Improved for Sustainable Harvest
GIS	-	Geographic Information System
GPH	-	Government of the Philippines
KII	-	Key Informant Interview
LG	-	Lingayen Gulf
LGU	-	Local Government Unit
LIT	-	Line-Intercept Transect
MEAT	-	MPA Management Effectiveness Assessment Tool
MERF	-	Marine Environment Resources Foundation
MKBA	-	Marine Key Biodiversity Area
MPA	-	Marine Protected Area
PMP	-	Performance Monitoring Plan
RFB	-	Reef Fish Biomass
SA	-	Sulu Archipelago
SBTPLG	-	San Bernardino Strait – Ticao Pass – Lagonoy Gulf
SDN	-	Surigao del Norte
SN	-	South Negros
UPVFI	-	University of the Philippines Visayas Foundation Inc.
USAID	-	United States Agency for International Development
VIP	-	Verde Island Passage

Executive Summary

At the end of five years, the ECOFISH Project is expected to achieve the two key results: (A) an average of 10% increase in fisheries biomass across the eight MKBAs and (B) a 10% increase in the number of people gaining employment or better employment from sustainable fisheries management from a baseline established at the start of the Project. The processes, methods of data collections, measurements and results presented in this document were designed at the onset of project implementation to determine these key project results. This Year 3 monitoring event provided insights into the process of measuring the project key results at the midstream and allow the team to make modifications and refinement to further improve, not just the results on itself, but also on the accuracy of data collection and calculation of parameters for the final monitoring event in 2017.

Fisheries, MPA, and socioeconomic assessments, similar to those conducted in Year 1, were performed. Project Result A was estimated from the combined result of change in catch rates of selected fishing gears and change in reef fish biomass in selected MPAs in focal areas. The change in catch rate was the percent change in average catch per unit effort (CPUE) of selected fishing gears monitored for three months in 2015 compared to the three-month baseline in 2013. The percent change in reef fish biomass were measured from selected MPAs monitored in 2015 compared to the baseline in 2013. On the other hand, Project Result B was based on the combined number of people gaining new employment and number of people gaining better employment measured through household surveys in the focal areas during the monitoring event in 2015 compared to the baseline in 2013.

For this Year 3 Monitoring Event, the Project Key Result A, the percentage increase (average of the 8 MKBAs) in fisheries biomass, is 5.95% and Project Key Result B, the percentage increase (average of the 7 MKBAs) in number of people gaining employment or better employment, is 27%.

The increase in fisheries biomass came mainly from MPAs. Six of the 8 MKBAs registered positive reef fish biomass results while increase in catch rates were achieved only in 4 of the 8 MKBAs. This can be attributed the timing of the fish catch monitoring. The Year 3 catch monitoring event was conducted 3 to 4 months ahead of schedule to coincide with the scheduled midterm evaluation of the project. This can be rectified by reverting back to the original schedule in the coming final monitoring event in 2017.

The combination of all socio-economic indicators shows that there is an overall improvement in the number of people gaining employment or better employment in 7 out of 8 project MKBAs. The increase came mainly from the improvement in net profits from fishing, shorter fishing trips, shorter travel times to fishing grounds and a general improvement in household savings. Results of monitoring of the number of households earning additional incomes from project interventions will be reported in Year 5. By then, social enterprises would have been established, or at the very least, initiated. In the final year of the project, a more in-depth analysis will be conducted using the results of the monitoring surveys. Successes and challenges of project interventions will be qualitatively correlated with the performance of the indicators (i.e. net profits from fishing, fishing patterns, perceptions and general economic indicators).

1. Introduction

The technical assistance and services contract was awarded to TetraTech – ARD for the implementation of USAID/Philippines' Ecosystems Improved for Sustainable Fisheries (ECOFISH) Project in June 29, 2012, under contract number AID-492-C-12-00008. The main objective of the ECOFISH Project is to improve the management of important coastal and marine resources and associated ecosystems that support local economies. The ECOFISH Project is intended to foster fishing sector reforms through the application of the Ecosystem Approach to Fisheries Management (EAFM) in larger marine conservation areas and involving clusters of Local Government Units (LGUs). It will promote the growth and restore the profitability of fisheries through conservation of ecosystem health and effective management.

The ECOFISH Project is in line with the current U.S. Country Assistance Strategy with respect to assistance directed at reducing threats to biodiversity and improving natural resources and environment. The ECOFISH Project is expected to contribute to achieving "Development Objective 3: Environmental Resilience Improved," particularly "IR3.2 Natural Resources and Environmental Management Improved" of the results framework of USAID/Philippine Mission's Country Development Cooperation Strategy (2012-2016). The Project is also designed to contribute to priority goals and actions laid out in the Philippine Development Plan (2011-2016) particularly Chapter 4 (Competitive and Sustainable Agriculture and Fisheries), and Chapter 10 (Protection, Conservation and Rehabilitation of Environment and Natural Resources). This five-year project will provide technical assistance to the Government of the Philippines (GPH), through the Department of Agriculture – Bureau of Fisheries and Aquatic Resources (DA-BFAR) and implemented in partnership with selected LGUs.

The main objective of the ECOFISH Project is to improve the management of important coastal and marine resources and associated ecosystems that support local economies. It will conserve biological diversity, enhance ecosystem productivity and restore the profitability of fisheries in eight marine key biodiversity areas (MKBAs) using the ecosystem approach to fisheries management (EAFM) as a cornerstone of improved social, economic and environmental benefits. The application of EAFM principles and practices is a proven approach for reversing the decline of fish abundance in municipal waters and for building community resilience. EAFM aims to manage fisheries at ecosystem scales rather than the scales defined by jurisdictional boundary limits. At the end of five years, the ECOFISH Project is expected to achieve the following key results:

(A) An average of 10% increase in fisheries biomass across the eight MKBAs;
(B) A 10% increase in the number of people gaining employment or better employment from sustainable fisheries management from a baseline established at the start of the Project;
(C) Establishment of a national capacity development program to enhance the capacities of LGUs and relevant national agencies to apply ecosystem-based approaches to fisheries management;
(D) Eight public-private partnerships supporting the objectives of the ECOFISH project created and operating;
(E) One million hectares of municipal marine waters under improved management; and
(F) A core of 30 LGUs across the eight MKBAs with improved capacity for implementing ecosystem approaches to fisheries management.

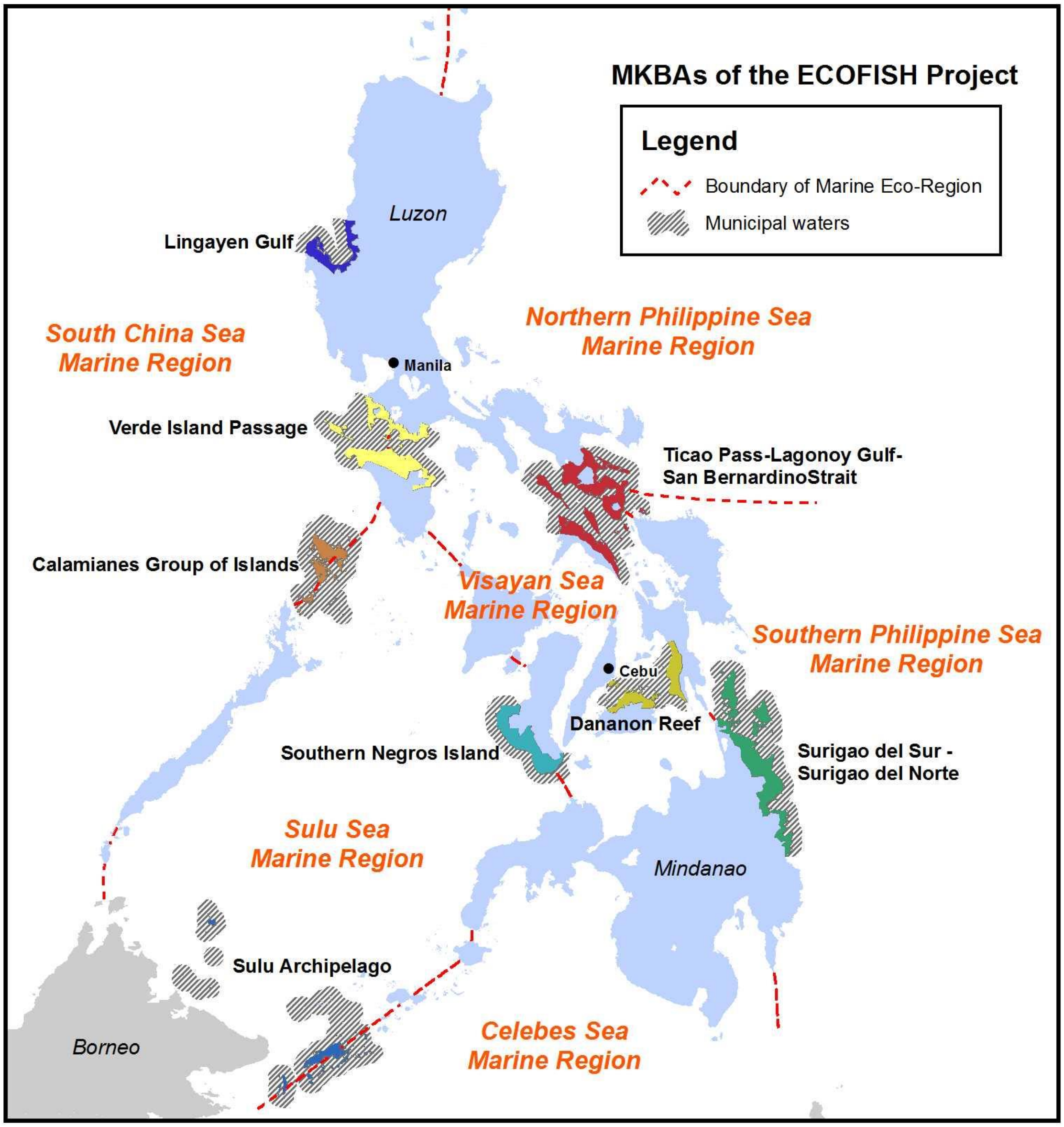
The ECOFISH Project is designed to make an impact on eight MKBAs in the country (Figure 1), namely: (1) the Calamianes Group of Islands MKBA, (2) Lingayen Gulf MKBA, (3) Ticao Pass – Lagonoy Gulf - San Bernardino Strait MKBA, (4) Danajon Reef MKBA, (5) South Negros MKBA, (6) Surigao del Sur and Surigao del Norte MKBA, (7) Sulu Archipelago MKBA, and (8) Verde Island Passage MKBA. They represent all six marine bio-regions of the Philippines and were selected due to their extremely high need for marine biodiversity conservation. These areas are marine ecosystem "hotspots" in the Philippines that mirror the common issues impacting capture fisheries locally and nationally, namely:

- loss of marine biodiversity;
- declining fish stocks;
- high population growth;
- limited private sector investment;
- inconsistent policies and programs for sustainable fisheries; and
- weak institutional and stakeholder capacity to plan and implement fisheries management.

This document summarizes the materials and methods used and the computed values of the main parameters from the monitoring event in Year 3 in comparison to the established baselines in Year 1 of project implementation. The focus of this document is on the key performance indicators that describe the status of marine fish stocks and employment, i.e., the project's key results to achieve: (a) an average of 10% increase in fisheries biomass across the eight MKBAs, and (b) a 10% increase in the number of people gaining employment or better employment from sustainable fisheries management from a baseline established at the start of the Project.

Information derived from the baseline assessments and monitoring events did not only serve as reference points for project performance. They also serve as input information to design and roll out fisheries management interventions as well as other programmatic interventions such as the drafting of fisheries management plans, vulnerability assessments, the national database on EAFM, the State of the Marine Resources Report, species and gear specific studies, MPA network analyses, cost-benefit analyses, and value chain analyses. In effect, other data were also collected and other parameters were also estimated in addition to those needed for the measurement of the key performance indicators. However, this report will only focus on the performance indicators and the process of measuring them.

This Year 3 Monitoring Report is guided by the Performance Monitoring Plan (ECOFISH Document No. 06/2013), the Baseline Assessment Plan (ECOFISH Document No. 07/2013), and the Baseline Assessment Report (ECOFISH Document No. 05/2014).



Quick summary of ECOFISH MKBAs

MKBA	ECOFISH Partner LGUs		ECOFISH Focal LGUs	
	n	Area of Municipal Waters (sq km)	n	Area of Municipal Waters (sq km)
Lingayen Gulf	17	2,934.6	8	1,150.1
Calamianes Group of Islands	4	10,377.8	4	10,377.8
Danajon Reef	20	4,912.7	13	2,863.3
South Negros Island	11	3,933.0	7	3,298.7
Sulu Archipelago	11	19,354.1	6	5,825.2
Surigao del Sur/del Norte	39	11,052.1	6	1,066.6
Verde Island Passage	26	9,031.7	9	1,559.7
Ticao Pass - Lagonoy Gulf - San Bernardino Strait	42	13,548.5	10	3,203.9

Figure 1. Location and key features of the eight marine key biodiversity areas (MKBAs) and respective focal areas of ECOFISH

2. Materials and Methods

This Year 3 Monitoring Report describes the materials and methods that were used during the baseline assessment in 2013 and the monitoring event in 2015 and corresponding results that are used as parameters for key the performance indicators at the start of the ECOFISH Project and three years into the implementation. These are the parameters that will be used to measure and monitor the increase in fisheries biomass and the number of people gaining employment or better employment resulting from ECOFISH management interventions.

2.1. Fisheries and MPA Baseline Assessment and Monitoring

The fisheries and MPA baseline assessment utilized the most practical methods applicable for typical exploited multispecies fish stocks in the tropics (like the Philippines). The choice of methods and parameters measured was based on the following considerations:

- Use assessment and monitoring methods appropriate to project goals that are cost efficient.
- Apply the best available scientific methods, and in particular, those methods previously used and tested in USAID's 7-year FISH Project.
- Select and modify methods to build on already established Philippine data collection methods.
- Only fisheries dependent methods shall be used to measure increase in biomass across MKBAs for purposes of cost efficiency.
- Subsequent assessments to evaluate project result in 2015 and 2017 shall be carried out in the same months when baseline data collections were conducted and taking into consideration the phase of the moon.
- Other fisheries related parameters to be measured shall supplement or serve as basis for evaluating the primary project result (10% increase in fish biomass).
- To the extent possible (without unduly sacrificing the accuracy of results for project evaluation purposes), practical methods shall be selected or designed such that, these can be carried out by the stakeholders beyond the life of the Project.

With the assistance of site coordinators, the Baseline Assessment and Monitoring Team assembled and reviewed all available secondary information about the fisheries in the MKBAs and, more specifically, in the focal areas. This initial step provided the team a general idea of the fisheries in the various focal areas, determine information deficiencies, and provide guidance on the appropriate and efficient field data collection protocol for fisheries and MPA baseline assessment in the focal areas.

2.1.1. Fisheries Baseline Assessment and Monitoring

Fisheries-dependent survey is the primary method used by ECOFISH to determine fisheries biomass in the focal areas across the eight MKBAs. This mainly involved catch and effort monitoring of all fishing activities during a definite period of time. In this case, a 3-month time series data was collected to determine catch per unit effort (CPUE) of municipal fishing gears operating in the focal areas. Landed catch of fishing gears were monitored for 3 straight months. The idea was to collect the same set of data during the baseline year in 2013 and repeated during subsequent project monitoring events to be conducted during the same 3-month period in 2015 and 2017. Enumerators were hired to do daily catch and effort monitoring in selected landing sites. The same months of the year were used in monitoring to determine increase or decrease in CPUE. The catch monitoring schedule followed a 3-day cluster scheme, designating the first 2 successive days for fieldwork and the third day as rest day. The scheme always starts on the first day of each month. This provides a higher likelihood of sampling both lean and peak days of fishing, covering holidays, weekends, and "must" fishing days, such as the eve of market days.

CPUE alone will only show the catch rate of a fisher operating a specific fishing gear. It does not, however, fully reveal the effect of changes in fishing pressure brought about by increase or decrease in the number of fishing gears or number of fishers. To determine this, additional sets of information were gathered including the total number of fishers operating in the focal areas, the total number and type of fishing gears being used, and the number of days of operation for the sampling duration. Non-fishing days for specific fishing gears influenced by the lunar phases, tidal fluctuations, magnitude of currents and weather conditions were noted and considered in the estimation of total landings. Together, these sets of information will provide estimates of the daily or monthly total landings by all gears operating in the focal areas.

An inventory of municipal fishing crafts (classified into motorized and non-motorized), fishing gears, and fishers in the focal areas was conducted. In addition, information about gear types, size, specifications, mode of operation, frequency of use, and seasonality of fishing operations were collected. These information, together with that on commercial fishing crafts (in case they are also operating in the area), will give baseline information on the level of fishing effort.

For catch monitoring purposes, the team identified major and minor municipal landing sites in the focal area. Sampling sites for catch data collection were selected in a manner that both major and minor landing sites are proportionately represented. Future catch monitoring activities will be conducted in the same sites and the same months of the year.

Enumerators were assigned in sampling sites and provided with gridded maps to locate the source of the catch. Information collected included the following: sampling site, date, and time; fishing ground location (with reference to map grids); fishing boat size, propulsion, horsepower, number of fishers; fishing gear type, specifications (design, dimension, mesh or hook size, bait used and accessories); mode of operation, number of hauls, time of setting and hauling; total weight of catch; species composition by weight and number; and length frequency distribution of important species. Information like the number of operation, harvesting, or landing per day were likewise noted. For relatively large catches, samples were taken. Fish samples were bought so as not to bother the fishers and also enable the enumerators to process more catches. All catch data were made convertible to kilograms per day. Species landed were recorded using either the scientific names (as identified) or their local names. Identification of their scientific names was undertaken using the taxonomic guides provided in Rau and Rau (1980) and Masuda *et al.* (1984). The fishing area for each of the monitored landed catch were recorded with reference to a gridded map of the focal area. The location of the landing sites and the gridded map were retained during the monitoring event in 2015 and the final monitoring in 2017.

To get accurate results from the catch and effort monitoring activities, a field training was conducted before the actual monitoring. This covered the purpose of catch and effort monitoring, introduction to the basic principles of sampling, elaboration of the project sampling design, catch sampling strategies, and proper behavior during the catch sampling process. Actual catch monitoring practice runs were conducted for several days for enumerators to practice and develop their skills following the proper sampling procedure.

The project result will be measured as percentage change in the weighted average of CPUEs of the fishing gears operating in each focal area. It will be weighted relative to the number of gears by gear type operating in the focal area. The overall average for the 8 MKBAs will be weighted relative to the area covered by the intervention, primarily represented by the selected focal area of each MKBA. As a support measurement to verify the catch rate trend, the percentage change in the weighted average of CPUEs of selected fishing gears (bottom set gill net or bottom set long line) common to all or majority of the focal areas will likewise be computed as another basis for estimating the specific project result of increase in fish biomass.

Key Informant Interviews and Focus Group Discussions

Since actual data collection is limited only to a 3-month duration, information on seasonal variations were captured through key informant interviews and focus group discussions. Qualified key informants at the barangay level are the presidents or chairs of people’s organizations, the barangay captain (especially if he or she is also a fisher), the barangay council chair of the fisheries and environment committee, fish wardens, and elderly fishers with long fishing experience. Information gathered include the following: types of fishing gears used by the fishers in their area, specifications, mode of operation (including seasonality of use), estimated average catch per day (seasonal variation, if applicable), and ranking of major species caught (including seasonal variation, if applicable).

Other Fisheries-Related Measurements

Fisheries management interventions, if successful, will not only positively affect CPUE, total landings, or stock density but in the long term, can also result in improvement of catch and size composition, particularly towards catching economically more valuable and larger fishes. These qualitative features will also be derived from data collected during the fishery-dependent surveys.

Species composition of catches by all fishing gears operating in the focal areas will serve as basis for comparison in future catch monitoring events. Putting them together, these sets of information will indicate the aggregate species mix during the baseline data collection for comparison with future catch monitoring events. Changes can be measured in terms of change in the abundance of commercially important species in the catch or in the average trophic level of the catch. As an added feature, the weight and number ratio can also be estimated and can provide an indicative value of the average size of each particular species of fish or invertebrate in the catch.

The mean sizes of various fishes caught by different fishing gears operating in the focal areas during the baseline year can serve as basis for comparison with future catch monitoring events. With individual lengths of fishes and invertebrates in the sorted catch measured, the length frequency distributions for species in the catch can be constructed and can serve as basis for future comparison. Through this, increase or decrease in average size through time can be statistically compared.

2.1.2. Marine Protected Area Baseline Assessment and Monitoring

Strengthening and establishing MPAs in each focal area to enhance fisheries production and marine ecosystem integrity is a major management mechanism of the ECOFISH Project. These MPAs form the building block of a network of MPAs being established in each MKBA. An MPA network is a group of MPAs that interact ecologically such that sources of eggs, larvae, and propagules in one MPA may enhance recruitment in another. It can protect a species or group of related species if the component MPAs are located in areas where such species are most vulnerable, such as, in aggregation sites, in critical habitats of particular life stages or along chosen points in migratory routes. As a key step towards MPA establishment, baseline assessment was conducted in existing MPAs or in potential new areas where MPAs will be established in each focal area.

A key activity prior to selection of MPAs was the inventory of existing MPAs in each MKBA. Existing MPAs, active or inactive, were evaluated using the MPA Management Effectiveness Assessment Tool (MEAT). MEAT as a tool have elements to gauge important threshold indicators and processes that help evaluate the management effectiveness of an MPA and, therefore guide the project in determining necessary inputs, interventions, or investments to promote effective MPA management. The selection of MPAs that will form part of the network as well as the immediate project intervention to strengthen management of existing MPAs were based on this.

Selection of Existing or Potential MPAs

The baseline assessments of MPAs were conducted in existing or potential MPAs that are likely to be included in the MPA networks to be established by the Project. Some focal areas contain MPAs that the project could build upon to develop into an MPA network. In other areas, no MPAs existed during the baseline assessment, thus requiring the identification of potential ones. Three MPAs within each focal area were selected for the surveys on the basis of information from discussions with local government officials, local fishers, and people's organizations.

Reef Fish Biomass Inside and Adjacent to Selected MPAs

Reef fish biomass and density were measured in three MPAs within each focal area. Reef fish assemblages were surveyed using the standard visual census techniques in English *et al.* (1997). All fish (including juveniles) encountered within 5 meters of either side of the 50-m transect line were identified and counted, and their size (total lengths) were estimated to the nearest 1cm. A minimum of five transects were surveyed inside (if already established) and another five outside of each selected MPA (or other reef site). Length data were converted to biomass estimates by using length-weight relationships in the literature. Biomass of major, target, and indicator species were separately estimated. Biomass estimates are expressed in metric tons per km^2 and density expressed as number of individuals per km^2.

As part of reef fish assessment described above, the number of species encountered in each transect were noted down, thus providing data on species richness. Species richness is expressed as number of species per km^2. The line-intercept transect (LIT) method (English *et al*. 1997) was used to obtain data on life form/genera that form the basis for assessing the percentage of living coral cover. In addition, the general characteristics of the reef site were also documented, such as depth, steepness of slope, general reef typology, and bottom rugosity. The baseline assessment of the benthic conditions were made simultaneously with reef fish assessment and along the same transect line.

2.1.3. Fisheries and MPA Baseline Assessment and Monitoring Activities and Schedule

Fisheries baseline data were collected in selected sampling sites within each focal area. Two core teams were formed, one for the MKBAs in the four old FISH Project sites and the other for the four new MKBAs. The first group was led by the prime contractor (Tetra Tech – ARD) while the other was led by MERF. A senior researcher supervised each core team supported by one junior researcher and 10 to 14 enumerators in each focal area. The two core teams collaborated to standardize the sampling method particularly learning from the lessons and knowledge gained during the catch monitoring by the FISH Project (FISH Project 2010).

Catch and effort monitoring in each focal area was conducted for a total period of 3 months. A coordinator was assigned to supervise the enumerators and perform weekly data encoding. Thematic leads and the site teams perform regular quality assurance and quality control (QAQC) process. Encoded data passed through a quality control prior to input into the performance monitoring database. Table 1 summarizes the actual dates of the conduct of fisheries baseline assessment and monitoring in the focal areas of the eight MKBAs.

Table 1. Start and end dates of year 1 (2013) fisheries baseline assessment and year 3 (2015) monitoring in the focal areas of the eight MKBAs.

Marine Key Biodiversity Area	Year 1 Baseline Assessment (2013)		Year 3 Monitoring (2015)	
	Start	End	Start	End
Calamianes Island Group	25 Mar 2013	05 Jul 2013	04 Dec 2014	16 Mar 2015
Danajon Reef	16 Mar 2013	23 Jun 2013	25 Jan 2015	07 May 2015
Lingayen Gulf	01 Jun 2013	28 Aug 2013	13 Feb 2015	26 May 2015
Southern Negros Island	01 Jun 2013	28 Aug 2013	13 Feb 2015	26 May 2015
Surigao del Norte and del Sur	25 May 201	04 Sep 2013	04 Feb 2015	17 May 2015
Sulu Archipelago	10 Jun 2013	20 Sep 2013	22 Feb 2015	04 Jun 2015
Ticao Pass – San Bernardino	01 Jun 2013	28 Aug 2013	14 Mar 2015	25 Jun 2015
Verde Island Passage	01 Jun 2013	28 Aug 2013	14 Mar 2015	25 Jun 2015

The baseline assessment team for the MPA assessment and monitoring was generally composed of two members that conducted fish visual census and four members that surveyed the benthic life forms. Table 2 summarizes the actual dates of the conduct of MPA baseline assessment and monitoring in the focal areas of the eight MKBAs.

Table 2. Start and end dates of year 1 (2013) marine protected area baseline assessment and year 3 (2015) monitoring in the focal areas of the eight MKBAs.

Marine Key Biodiversity Area	Year 1 Baseline Assessment (2013)		Year 3 Monitoring (2015)	
	Start	End	Start	End
Calamianes Island Group	23 Sep 2013	26 Sep 2013	25 May 2015	27 May 2015
Danajon Reef	05 Oct 2013	08 Feb 2013	13 Apr 2015	15 Apr 2015
Lingayen Gulf	20 May 2013	31 May 2013	16 Mar 2015	20 Mar 2015
Southern Negros Island	06 May 2013	10 May 2013	23 Mar 2015	20 Mar 2015
Surigao del Norte and del Sur	11 Nov 2013	16 Nov 2013	24 Mar 2015	26 Mar 2015
Sulu Archipelago	05 Dec 2013	08 Dec 2013	05 May 2015	08 May 2015
Ticao Pass – San Bernardino	19 Aug 2013	20 Aug 2013	06 Mar 2015	09 Mar 2015
Verde Island Passage	06 Aug 2013	10 Aug 2013	26 Feb 2015	28 Feb 2015

2.1.4. Estimation Procedure to Determine Change in Fisheries Biomass

This section describes the calculation processes in estimating the change in fisheries biomass during the Year 3 monitoring event relative to the baseline established in Year 1. The calculation processes will enable the project to determine ECOFISH Project Result A, that is,

"An average of 10% increase in fisheries biomass across the eight MKBAs".

This Project Result is computed as the difference between project results measured in 2015 and 2013 expressed as percentage change. The first component of Project Result A is the catch rate, in this case, the average catch per unit effort (CPUE) of selected fisheries in the focal areas. The average CPUE is the proxy estimate of fish biomass in the focal areas. The computation will be the percentage change in CPUE, compared to baseline, using fisheries dependent methods. Information to compute for these parameters will primarily be collected through catch and effort monitoring and further supported by information from key informant interviews (KII).

The basic parameters used to measure the change in biomass are the weighted averages of catch per unit effort of various fishing gears used during the 3-month catch and effort monitoring using the number of samples as weighing factor:

$$\overline{CPUE}_{baseline} = \frac{(CPUE_1 \cdot n_1) + (CPUE_2 \cdot n_2) + \ldots + (CPUE_n \cdot n_n)}{n_1 + n_2 + \ldots + n_n}$$

where: $\overline{CPUE}_{baseline}$ = proxy estimate of fish biomass represented by the weighted average catch per unit effort estimated using fishery-dependent surveys

$CPUE_1$ = average catch per operation of 1st fishing gear type monitored

$CPUE_2$ = average catch per operation of 2nd fishing gear type monitored

$CPUE_n$ = average catch per operation of nth fishing gear type monitored

n_1 = number of samples of the 1st fishing gear type monitored

n_2 = number of samples of the 2nd fishing gear type monitored

n_n = number of samples of the nth fishing gear type monitored.

The change in biomass **(**ΔCPUE) is measured as the change in the catch per unit of effort of selected fisheries surveyed using fisheries-dependent methods:

$$\Delta CPUE = \frac{\overline{CPUE}_{monitoring} - \overline{CPUE}_{baseline}}{\overline{CPUE}_{baseline}} \cdot 100$$

where: ΔCPUE	=	change in CPUE estimated using fishery-dependent survey methods
$\overline{\text{CPUE}}_{\text{baseline}}$	=	weighted average catch per unit effort of gears used in the fisheries-dependent survey during baseline assessment
$\overline{\text{CPUE}}_{\text{monitoring}}$	=	weighted average catch per unit effort of gears used in the fisheries-dependent survey during monitoring
100	=	multiplier to express the result as percent change.

The second component of Project Result A is the reef fish biomass, in this case, the average reef fish biomass inside and adjacent to MPAs in the focal areas. The computation will be the percentage change in reef fish biomass, compared to baseline, using MPA assessment methods. Information to compute for these parameters were primarily collected through fish visual census.

The basic parameters used to measure the change in reef fish biomass are the weighted averages of reef fish biomass using the area of the MPA as weighing factor:

$$\overline{MPABiom}_{baseline} = \frac{(RFishBiom_1 \cdot a_1) + (RFishBiom_2 \cdot a_2) + \ldots + (RFishBiom_n \cdot a_n)}{a_1 + a_2 + \ldots + a_n}$$

where: $\overline{\text{MPABiom}}_{\text{baseline}}$	=	MPA fish biomass represented by the weighted average reef fish biomass estimated using MPA assessment methods
RFishBiom_1	=	average reef fish biomass of 1st MPA surveyed
RFishBiom_2	=	average reef fish biomass of 2nd MPA surveyed
RFishBiom_n	=	average reef fish biomass of nth MPA surveyed
a_1	=	area of the 1st MPA surveyed
a_2	=	area of the 2nd MPA surveyed
a_n	=	area of the nth MPA surveyed.

The change in biomass **(**ΔMPABiom) is measured as the change in the reef fish biomass of MPAs surveyed using MPA assessment methods:

$$\Delta MPABiom = \frac{\overline{MPABiom}_{monitoring} - \overline{MPABiom}_{baseline}}{\overline{MPABiom}_{baseline}} \cdot 100$$

where: ΔMPABiom	=	change in MPA biomass estimated using MPA assessment methods
$\overline{\text{MPABiom}}_{\text{baseline}}$	=	weighted average of reef fish biomass of MPAs surveyed during baseline assessment
$\overline{\text{MPABiom}}_{\text{monitoring}}$	=	weighted average of reef fish biomass of MPAs surveyed during monitoring
100	=	multiplier to express the result as percent change.

The average change in fisheries biomass **(**ΔB) is the combination of both the catch rate (proxy estimate of fish biomass outside the reef areas) and reef fish biomass components and estimated using the following:

$$\Delta B = \frac{(\Delta CPUE \cdot w_c) + (\Delta MPABiom \cdot w_m)}{w_c + w_m}$$

where: ΔB = change in fisheries biomass
ΔCPUE = change in CPUE estimated using fishery-dependent survey methods
ΔMPABiom = change in MPA biomass estimated using MPA assessment methods
w_c = weighing factor for fishery-dependent survey methods
w_m = weighing factor for MPA assessment methods

The weighing factors scaled the components relative to the area they cover in their respective focal areas (Table 3) as well as the potential yield (Table 4). For the estimation of the overall weighted average of all the focal areas of the eight MKBAs, weighing factors were likewise applied and the values are proportionate to the areas covered by the respective area of coverage of each focal area.

Table 3. Estimates of areas of municipal waters, soft/hard bottom, and coral reefs in the focal areas of the eight MKBAs.

MKBA	Area (in km^2) of components in the focal area		
	Municipal waters	Hard/Soft bottom	Coral reefs
Calamianes Island Group	11,109	10,651	458
Danajon Reef	2,769	2,380	388
Lingayen Gulf	1,172	1,158	13
San Bernardino - Ticao Pass - Lagonoy Gulf	3,152	3,050	102
South Negros Island	3,308	3,286	22
Sulu Archipelago	5,497	4,785	711
Surigao del Sur and Surigao del Norte	1,173	1,121	52
Verde Island Passage	2,746	2,711	35

Table 4. Estimates of annual potential harvest (tons/km^2) of various marine habitats in the Philippines.

Bottom type and depth	Estimated annual average harvest	Source
0-200 meters	3.50 t/km^2 (demersal species)	Kvaran, 1971
0-200 meters	3.25 t/km^2 (in-shore pelagic species)	Kvaran, 1971
200 meters and deeper	0.20 t/km^2 (off-shore pelagic species	Kvaran, 1971
Reef area	15.6 t/km^2 (all fishes)	White & Trinidad 1998; Russ 1991. Alcala & Gomez 1985.
Estuary	17.0 t/km^2 (all fishes)	Pauly, 1982

The weighting factor for the catch rates (w_c) is defined as the product of collective potential yields of demersal and pelagic stocks (Table 4) and the area covered by the hard and soft bottom substrates (Table 3). The potential yields of both the demersal and pelagic stocks were used since catch and effort of both demersal and pelagic fisheries were monitored. And similarly, hard and soft bottoms were not segregated because there are no reliable geological and hydrographic data to serve as reference.

$$w_c = \frac{(PY_{dem} + PY_{pel}) \times (A_{hs})}{2}$$

where: w_c = weighting factor for catch rates (proxy value for fish biomass)
PY_{dem} = Potential yield (t/km^2/yr) for the demersal stock
PY_{pel} = Potential yield (t/km^2/yr) for the pelagic stock
A_{hs} = Area (km^2) of hard and soft bottom
2 = This divisor is needed, since both weighting factors cover the same area, to avoid double counting.

The weighting factor for reef fish biomass is the product of the potential yield of coral reef ecosystem (Table 4) and the extent of the coral reef in each focal area (Table 3). Only the area of the coral reef was used as basis since all MPA initiatives of the ECOFISH are focused on coral reef ecosystems and their associated communities such as sea grass beds. The value may increase once habitat protection initiatives are also initiated in other fish habitat systems like mangrove forests. Increasing this area and value will mean decreasing the hard and soft bottom areas and values. The approach is rational and captures the initiatives the ECOFISH is investing the establishment and making MPAs and network of MPAs more effective in the areas.

$$w_m = PY_{cor} \cdot A_{cor}$$

where: w_m = weighting factor for reef fish biomass
PY_{cor} = Potential yield (t/km^2/yr) for the coral reef
A_{cor} = Area (km^2) of coral reef

2.2. Socio-Economic Baseline Assessment and Monitoring

The socio-economic monitoring assessment intends to measure the progress of ECOFISH in reaching the project's target of a 10% increase in the number of people gaining employment or better employment from sustainable fisheries management.

Measurement will be based on a combination of parameters including household incomes, household expenditures, resource uses, and employment. Percentage changes will be used for the sample population directly relying on their coastal and marine resources for their primary livelihoods. Improvement may come from increased incomes, which in turn may come from increased savings, increased expenditures for improving standards of living, or decreased costs in fishing due to shorter distances of time spent fishing. It may also come in the form of better employment opportunities, away from traditional catch harvesting. Finally, it may come in the form of improved health status or social standing in the community due to improvements in the status of their coastal and marine resources.

The project team developed a socio-economic baseline survey to assess the effects of activities on all program outcomes. The survey included basic questions on social and economic indicators, which will be used to measure impact against intended results. The survey was repeated in year 3, and responses of the same households were measured and compared with the previous baseline survey results to measure the socio-economic impacts of the project. The same survey will be conducted in year 5 to come up with the overall measurement of the project's success or failure in achieving the target.

The socio-economic baseline was established primarily through a survey of individual households. The sample was set at a minimum of 500 households per MKBA for eight project sites. Random sampling was employed in choosing the individual households. The choice of barangays (or villages) was made consistent with the choice of barangays covered by the biophysical surveys. In year 3, the same individual households were covered for the monitoring event. In cases where respondents were no longer fishers (due to change of livelihood or deceased), or were no longer residing in their original residence during the time of the baseline survey, these were not replaced with other fishing households. In effect, the sample size in year 3 is now smaller than the baseline. For the Sulu Archipelago (SA) MKBA, baselines had to be re-established in 2015 due to inconsistencies in data gathering and survey methods employed by the enumerators. Hence, monitoring results are presented only for 7 MKBAs. In tables where only changes or trends are shown, the SA MKBA is removed from the list. A complete list of MKBAs will be shown for the final monitoring report, with the caveat that SA data will refer to 2015 and 2017 only.

2.2.1. Socio-Economic Baseline Assessment and Monitoring Tool

The survey is divided into four major parts: social and demographic profile of the fishing household, general economic profile including household's sources of income and expenditures, perceptions of the respondent with respect to conditions of, and threats to marine resources as well as perceptions on enforcement of fishing rules and regulations, and finally, the profile of fishing households with respect to fishing practices, income and expenditures.

The demographic profile contains basic information on family size, age, ethnicity, religion, number of females in the household, civil status and educational attainment of the respondent. It further asks about house and lot ownership, housing materials, amenities, appliances, cooking fuel and drinking water sources, sanitation facilities, and waste management practices. Finally, seafood consumption and health conditions are included as health indicators of fisherfolk households.

The economic profile consists of top livelihood sources, household expenditures, and the various sources of income for the household. Household expenditure items are made consistent with national surveys on family income and expenditures.

Perceptions of respondents were gathered, focusing on primary opportunities and challenges in their respective barangays, their own qualitative assessment of conditions and threats to marine resources, their knowledge and views of MPAs in their areas, and their subjective rating of the various parts of the enforcement chain.

The last part consisted of questions dealing with most common gears used and top species caught, fishing profiles, average volumes harvested and sold, incomes and costs from harvesting activities, and measurements of economic rent. Respondents were asked to rate the demand for the top species they catch, as well as the primary markets and buyers they cater to.

2.2.2. Key Informant Interviews and Focus Group Discussions

To complement the household surveys particularly in determining which barangays would have the highest concentration of marginal fisherfolk for the conduct of the household surveys, KIIs and FGDs were conducted with selected local government officials in the focal areas of the project. Discussions focused on population demographics, the presence of or potential for the establishment of MPAs, common issues regarding capture fisheries, mariculture and aquaculture, other major livelihood activities of the community, issues related to governance and enforcement of fishing rules and regulations, potentials for ecotourism or other marine-related enterprises, current and potential revenue generating schemes for the implementation of CRM, and species of interest for value chain studies.

2.2.3. Start and End Dates of Year 1 (2013) Socioeconomic Baseline Assessment and Year 3 (2015) Monitoring in the Focal Areas of the Eight MKBAs

A week of planning, focus group discussions, key informant interviews, and training of enumerators were conducted for each MKBA. Site teams were asked to conduct the following preparatory activities in preparation for the FGDs and enumerators' training:

- Hiring of ten to twelve local enumerators to conduct the whole survey.
- Scheduling of LGU visits.
- Assistance in choosing the municipalities to be covered by the survey, and assistance in choosing barangays within focal municipalities to be covered. Ideal breakdown is six barangays per municipality, 30 households per barangay, for a total of 540 households in each MKBA. Adjustments were made accordingly if there were less than 6 barangays with fishers in the identified municipality.
- Procurement of barangay maps, list of residents per barangay covered by the survey, total number of fisherfolk per barangay, and total population per barangay.
- Logistical arrangements for the site visit: lodging, transportation arrangements, etc.

Trainings were conducted for 2 days in each MKBA. Day 1 consisted of providing an overview of the ECOFISH project and the socioeconomics baseline assessment activity, as well as an itemized discussion of the survey instrument. The second day was dedicated to conducting mock interviews, providing tips in conducting household surveys, choosing the households to be surveyed based on random sampling techniques, detailed scheduling in each barangay, and budget concerns. Surveys were typically completed in 30 to 45 days per MKBA. The site coordinator and CRS were assigned to supervise the enumerators and perform quality assurance and quality control (QAQC). Data passed through a quality control process prior to input into the performance monitoring database. Table 5 summarizes the actual dates of the conduct of socioeconomic baseline assessment and monitoring in the focal areas of the eight MKBAs.

Table 5. Start and end dates of year 1 (2013) socioeconomic baseline assessment and year 3 (2015) monitoring in the focal areas of the eight MKBAs.

Marine Key Biodiversity Area	Year 1 Baseline Assessment (2013)		Year 3 Monitoring (2015)	
	Start	End	Start	End
Calamianes Island Group	25 Mar 2013	05 Jul 2013	04 Dec 2014	16 Mar 2015
Danajon Reef	29 Apr 2013	19 Jun 2013	21 Jan 2015	21 Feb 2015
Lingayen Gulf	14 May 2013	07 Jun 2013	27 Feb 2015	20 Mar 2015
Southern Negros Island	22 Apr 2013	28 May 2013	21 Mar 2015	18 Apr 2015
Surigao del Norte and del Sur	8 Apr 2013	9 May 2013	20 Feb 2015	17 Mar 2015
Sulu Archipelago	22 Mar 2013	28 Apr 2013	30 Mar 2015	27 Apr 2015
Ticao Pass – San Bernardino	22 Jun 2013	28 Sep 2013	9 Feb 2015	24 Apr 2015
Verde Island Passage	21 Feb 2013	22 Mar 2013	16 Feb 2015	19 Mar 2015

2.2.4. Estimation Procedure to Determine Change in People Gaining Employment or Better Employment

This section describes the calculation processes in estimating the change in people gaining employment or better employment during the Year 3 monitoring event relative to the baseline established in Year 1. The calculation processes will enable the project to determine ECOFISH Project Result B, that is,

> **"A 10% increase in the number of people gaining employment or better employment from sustainable fisheries management from a baseline established at the start of the project".**

Measurement was based on a combination of parameters including household incomes, household expenditures, resource uses, and employment. Percent changes were estimated for the sample population directly relying on their coastal and marine resources for their primary livelihoods. Improvement may come from increased incomes, which in turn may come from increased savings, increased expenditures for improving standards of living, or decreased costs in fishing due to shorter distances of time spent fishing. It may also come in the form of better employment opportunities, away from traditional catch harvesting. Finally, it may come in the form of improved health status or social standing in the community due to improvements in the status of their coastal and marine resources.

The change in the number of people gaining employment or better employment ΔE is measured from the following:

$$\Delta E = \Delta NP + \Delta HS + \Delta SF + \Delta EF + \Delta MPA + \Delta EQ + \Delta LT + \Delta TT + \Delta FG + \Delta PP - \cap\,(\Delta NP, \Delta HS, \Delta SF, \Delta EF, \Delta MPA, \Delta EQ, \Delta LT, \Delta TT, \Delta FG, \Delta PP)$$

where: ΔE = percent change in number of people gaining employment or better employment from sustainable fisheries management (number of people with more increase than decrease among the indicators)

ΔNP = percent change in number of people with higher net profits from fishing (number of people with higher net profits less the number of people with lower net profits from fishing)

ΔHS = percent change in number of people with higher household savings (number of people whose savings increased less the number of people whose savings decreased)

ΔSF = percent change in number of people eating seafood more regularly (number of people eating seafood more regularly less the number of people eating seafood less regularly)

ΔEF = percent change in number of people with perceived improvements in enforcement (number of people with perceived improvements in enforcement less the number of people with perceived worsening of enforcement)

ΔMPA = percent change in number of people with higher awareness and support for MPAs (number of people with higher awareness and support for MPAs less the number of people with lower awareness and support for MPAs)

ΔEQ = percent change in number of people with higher perceptions of improved environmental quality (number of people with perceptions of improved environmental quality less the number of people with perceptions of worsening environmental quality)

ΔLT = percent change in the number of people with shorter fishing trips (number of people with shorter fishing trips less the number of people with longer fishing trips)

ΔTT = percent change in the number of people with shorter travel time to fishing grounds (number of people with shorter travel time to fishing grounds less the number of people with longer travel time to fishing grounds)

ΔFG = percent change in number of people using less destructive or friendlier gears (number of people using friendlier gears less the number of people using more destructive gears)

ΔPP = percent change in number of people employed through project interventions

$\cap(\Delta NP, \Delta HS, \Delta SF, \Delta EF, \Delta MPA, \Delta EQ, \Delta LT, \Delta TT, \Delta FG, \Delta PP)$ = the intersections of two or more of the above

The removal of the intersection is to prevent the double counting of values common to both or to any combination of parameters. Two additional variables, ΔLT (percent change in the number of people with shorter fishing trip and ΔTT (percent change in the number of people with shorter travel time to fishing grounds), were included to represent other expenditures in fishing. These were not captured by the fishing costs.

3. Results and Discussion

The results presented in this document include parameters for estimating the key project results namely, an average of 10% increase in fisheries biomass across the eight MKBAs and a 10% increase in the number of people gaining employment or better employment from sustainable fisheries management, compared to a baseline data established at the start of the project.

3.1. Fisheries and MPA Baseline Assessment and Monitoring

3.1.1. Fisheries Baseline Assessment and Monitoring

A total of 84 landing sites (Table 6) in 29 municipalities were selected for the catch monitoring in the focal areas across the eight MKBAs. As mentioned earlier the sampling sites for catch data collection were selected in such a manner that both major and minor landing sites are proportionately represented. Future catch monitoring activities to evaluate the project result shall be conducted in the same sites selected and the same months of the year. For the Year 1 baseline assessment and the Year 3 monitoring event, a total of 15,500 and 23,365 fisheries catch and effort data, respectively, were collected and processed.

Catch samples were collected from between 16 to 42 fishing gear types during baseline assessment and monitoring in the focal area across the eight MKBAs. A number gear types were encountered at least once while others at most 1,880 times during the 3-month sampling. Commonly used fishing gears across were the simple hook and line, bottom-set gillnet, bottom-set longline, drift gillnet and multiple handline. Tables 7 to 14 summarize the average catch rates (kilogram/day), standard deviations, and frequency of sampling per gear type. As a general observation, the mean catch rates of various fishing gears were relatively higher in Tawi-Tawi and Verde Island Passage MKBAs while relatively lower in Danajon Reef and Lingayen Gulf MKBAs. Ring net consistently have the highest catch rates (kg/day) in areas where they are still allowed to operate. Danajon Reef consistently has the lowest catch rates across the eight MKBAs for gears common to all, such as simple hook and line and bottom set gill net, are compared.

Table 6. Fish landing sites selected for the fisheries-dependent survey in the eight MKBAs during the baseline assessment in 2013 and monitoring in 2015.

Municipality/Landing Site	
Calamianes Island Group MKBA	
Busunga	
	Bogtong
	Salvacion
Coron	
	Barangay 1-Bakawan
	Barangay 1-Comesaria
	Barangay 2
	Barangay 5-Bancuang
	Bintuan
	Bulalacao
	Diguiboy
	Maquinit
	Tagumpay
Culion	
	Balala
	Bernabe
	Chindonan
	Culango
	Jardin
	Libis
	Osmena
	Sitio Pescadores
Danajon Bank MKBA	
Buenavista	
	Asinan
Clarin	
	Nahawan
Getafe	
	Handumon
	Nasingin
	Pandanon
Inabanga	
	Cuaming
	Hambongan
	Lawis
	Sto Nino
Tubigon	
	Bagongbanwa
	Pandan
	Tinagan
Lingayen Gulf MKBA	
Agoo	
	Bani
	Damortis
Alaminos	
	Bolo Islands, Telbang
San Fernando	
	Ilacanos Sur
	Poro
San Bernardino – Ticao Pass – Lagonoy Gulf MKBA	
Bulan	
	Bulan
Matnog	
	Tablac
Santa Magdalena	
	Barangay 1
	Barangay 3
	Poblacion 4
South Negros MKBA	
Bayawan City	
	Banga
	Buyco
	Malabugas
	Pagatban
	Suba Port
	Tinago
Santa Catalina	
	Cawitan
	Fatima
	San Pedro
Siaton	
	Agbagacay
	Albiga
	Malabuhan
	Maloh
	Nagba
	Nasipit
Surigao del Norte and del Sur MKBA	
Bacuag	
	Poblacion
Claver	
	Panatao
Gigaquit	
	Gigaquit Public Market
	Nagubat
	Punta Alambique
Placer	
	Banga
Surigao City	
	Punta Bilar
Taganaan	
	Cawilan
	Sampaguita
Verde Island Passage MKBA	
Calatagan	
	Balibago
	Balombato
	Burot
	Poblacion 2
	Poblacion 4
Mabini	
	Pantalan Anilao
Tingloy	
	Santo Tomas
	Tingloy
Tawi-Tawi MKBA	
Bongao	
	Chinese Pier
	Kasulutan
	Lamion
	Public Market
Panlima Sugala	
	Batu-Batu
Simunul	
	Bakong
	Mastul
	Pagasinan
	Sukah Bulan
	Tubig Indangan
	Ubol

Table 7. Catch per unit effort (kg/day) of fishing gears monitored in selected landing sites in the Calamianes Island Group MKBA during the fisheries baseline assessment conducted in 2013 and monitoring in 2015.

		2013					2015				
	Gear type	**CPUE**	**n**	**Min**	**Max**	**sd**	**CPUE**	**n**	**Min**	**Max**	**sd**
1	Bag net	228.4	129	0.4	3995.0	457.6	155.3	88	2.0	935.0	183.5
2	Barrier gillnet	5.0	1	5.0	5.0		5.0	1	5.0	5.0	
3	Beach seine						6.5	3	5.0	9.2	2.4
4	Bottom set gillnet	9.5	665	0.5	80.0	9.3	13.6	256	0.3	160.0	21.6
5	Bottom set longline	9.4	402	0.3	71.0	6.4	9.3	208	0.7	44.0	6.7
6	Crab gillnet						3.2	43	0.5	12.9	2.8
7	Crab liftnet						24.0	1	24.0	24.0	
8	Crab pot	5.0	1	5.0	5.0		3.9	10	1.5	8.4	2.6
9	Drag handline	33.1	26	3.3	95.0	27.7					
10	Drift gillnet	13.7	110	0.5	83.0	13.5	15.6	57	0.7	60.0	14.2
11	Dynamite	60.0	1	60.0	60.0		61.0	1	61.0	61.0	
12	Encircling gillnet	7.7	7	4.5	11.5	2.8	7.5	6	4.1	11.5	3.0
13	Fish corral	10.0	39	1.0	80.0	13.9	15.3	5	3.2	36.0	13.7
14	Fish jig						1.7	68	0.2	10.0	1.3
15	Fish trap	6.8	31	1.1	16.2	4.9	9.4	11	5.6	15.1	4.0
16	Gleaning	2.6	10	0.9	7.0	1.9	7.7	13	0.2	50.0	14.2
17	Hook and line with float	4.8	5	3.0	7.6	1.7					
18	Multiple handline	3.1	305	0.3	40.0	4.6	4.0	169	0.1	21.0	3.2
19	Octopus jig	13.2	5	8.0	19.0	5.0					
20	Push/Scissor net						0.9	31	0.2	4.0	0.8
21	Scoopnet with light	3.3	1	3.3	3.3		1.5	20	0.2	4.9	1.4
22	Seine net						22.8	3	2.3	57.9	30.6
23	Set gillnet with plunger	19.5	15	0.8	100.0	31.0	10.5	38	1.0	27.0	7.3
24	Simple hook and line	3.3	250	0.1	59.6	5.3	6.1	98	0.2	75.0	10.6
25	Spear	13.9	52	1.3	89.8	14.2	6.8	37	0.8	30.6	6.3
26	Spear with compressor	20.4	135	1.5	180.0	20.6	20.5	12	5.5	57.5	16.3
27	Squid jig	1.6	12	0.6	3.8	1.0	2.7	71	0.1	11.0	1.9
28	Trammel net	10.0	96	1.9	34.0	5.7	11.9	145	1.6	50.0	7.8
29	Troll line	18.4	268	1.3	78.8	15.2	13.3	130	0.4	84.0	16.3

Table 8. Catch per unit effort (kg/day) of fishing gears monitored in selected landing sites in the Danajon Reef MKBA during the fisheries baseline assessment conducted in 2013 and monitoring in 2015.

		2013					2015				
	Gear type	**CPUE**	**n**	**Min**	**Max**	**sd**	**CPUE**	**n**	**Min**	**Max**	**sd**
1	Barrier gillnet	0.6	4	0.3	1.0	0.3					
2	Barrier net	2.0	1	2.0	2.0						
3	Bottom set gillnet	1.8	567	0.0	29.7	3.0	2.3	1888	0.0	69.0	4.0
4	Bottom set longline	4.5	542	0.0	40.0	4.7	5.2	790	0.0	40.0	4.9
5	Crab gillnet	1.8	502	0.0	11.4	1.4	1.6	861	0.2	10.2	1.0
6	Crab liftnet						2.5	15	0.7	4.0	0.9
7	Crab pot	2.6	125	0.6	6.8	1.0	2.7	511	0.2	20.0	1.8
8	Danish seine	10.8	86	3.0	20.2	3.9	22.0	128	0.9	91.7	20.8
9	Diving	4.2	79	0.5	15.0	3.2	2.7	341	0.0	28.0	2.5
10	Drag handline	18.2	87	0.0	67.2	12.7	17.8	163	0.0	70.5	15.2
11	Drift gillnet	22.9	203	0.0	324.0	44.3	14.0	284	0.0	180.0	25.6
12	Drive-in gillnet	30.5	42	1.2	130.0	30.8	5.4	45	0.9	13.5	3.1
13	Dynamite	14.3	16	0.0	100.6	25.7	9.3	91	0.2	111.6	17.9
14	Eel pot	3.6	91	0.7	7.7	1.5					
15	Entrapping device						0.8	5	0.3	1.1	0.3
16	Filter net						11.1	4	2.5	20.0	7.9
17	Fish corral	2.4	245	0.1	27.7	2.8	3.4	635	0.0	15.5	1.9
18	Fish jig						1.2	2	1.0	1.5	0.4
19	Fish pot						4.2	12	0.9	11.0	3.9
20	Fish trap	6.0	62	0.3	38.0	9.2	2.4	10	0.2	5.0	1.6
21	Gleaning						2.0	18	0.2	5.4	1.5
22	Hook and line with float	2.9	30	0.0	10.2	2.2	2.6	5	0.8	4.8	1.6
23	Multiple handline	2.6	265	0.0	9.3	1.9	2.0	527	0.0	15.6	1.5
24	Octopus lure						2.5	11	0.0	6.0	2.3
25	Push/Scissor net	3.2	9	0.5	11.0	3.1	1.3	16	0.2	2.1	0.5
26	Ring net	546.4	82	0.0	2400.0	528.6	203.8	46	15.0	900.0	200.3
27	Scoopnet with light						0.7	36	0.2	1.6	0.3
28	Seine net	6.5	48	0.5	10.0	1.8	11.8	97	0.0	120.0	20.2
29	Set gillnet						2.8	103	0.0	11.0	2.7
30	Set gillnet for rays						2.2	9	0.0	4.4	1.6
31	Set gillnet with plunger	6.2	25	0.0	18.0	4.3	2.9	28	0.6	6.3	1.3
32	Set longline						3.3	55	0.0	36.1	7.0
33	Set longline for squid						1.0	2	0.6	1.4	0.6
34	Simple hook and line	2.2	248	0.0	12.0	1.6	2.0	404	0.0	10.0	1.3
35	Spear	4.1	127	0.0	14.0	2.2	1.4	356	0.0	18.0	1.4
36	Spear with compressor	26.0	222	3.5	80.0	14.8	25.1	58	3.1	73.0	14.8
37	Squid gillnet	6.8	127	0.9	15.6	3.3	9.2	93	0.8	38.3	5.8
38	Squid jig	1.3	27	0.4	3.7	0.7	1.4	114	0.0	6.0	1.1
39	Squid trap						12.6	1	12.6	12.6	
40	Trammel net	7.7	62	0.3	19.1	4.3	2.6	36	0.5	11.8	2.5
41	Troll line	3.0	32	0.0	31.0	5.5	2.7	163	0.0	25.5	4.1
42	Troll line for garfish	2.0	4	1.3	3.5	1.0					

Table 9. Catch per unit effort (kg/day) of fishing gears monitored in selected landing sites in the Lingayen Gulf MKBA during the fisheries baseline assessment conducted in 2013 and monitoring in 2015.

		2013					2015				
	Gear type	**CPUE**	**n**	**Min**	**Max**	**sd**	**CPUE**	**n**	**Min**	**Max**	**sd**
1	Bag net						57.5	147	0.0	171.0	40.8
2	Barrier gillnet						7.0	1	7.0	7.0	
3	Bottom set gillnet	4.2	385	0.2	150.0	9.8	2.5	351	0.0	51.9	3.3
4	Bottom set longline						7.1	26	0.0	20.0	5.3
5	Cast net	4.9	7	1.0	10.1	2.8					
6	Drift gillnet						6.5	7	1.0	20.0	6.6
7	Encircling gillnet						47.0	1	47.0	47.0	
8	Fish trap	3.2	17	0.8	8.0	2.0	14.2	7	6.7	23.0	6.8
9	Harpoon fishing with lights	4.0	1	4.0	4.0						
10	Hook and line with float						15.5	25	0.3	55.0	13.6
11	Multiple handline	16.8	174	0.3	90.4	14.0	5.7	167	0.0	40.0	5.6
12	Scoopnet with light						1.5	75	0.1	20.0	2.8
13	Simple hook and line						15.9	176	0.0	104.3	19.8
14	Spear						5.0	35	0.6	13.0	3.2
15	Squid jig	1.9	6	0.7	4.0	1.2					
16	Trawl						233.1	51	140.0	640.0	79.6

Table 10. Catch per unit effort (kg/day) of fishing gears monitored in selected landing sites in the San Bernardino Strait – Ticao Pass – Lagonoy Gulf MKBA during the fisheries baseline assessment conducted in 2013 and monitoring in 2015.

		2013					2015				
	Gear type	**CPUE**	**n**	**Min**	**Max**	**sd**	**CPUE**	**n**	**Min**	**Max**	**sd**
1	Bottom set gillnet	18.1	182	0.3	250.0	34.7	20.0	246	0.0	200.0	27.2
2	Bottom set longline	10.0	1	10.0	10.0		17.4	110	0.0	80.0	12.5
3	Crab gillnet	5.3	37	1.2	11.0	2.4	4.5	11	0.4	11.0	3.0
4	Crab pot						4.1	35	0.3	24.0	3.9
5	Drift gillnet	39.6	208	0.5	465.0	66.2	14.6	69	1.0	100.0	16.8
6	Drive-in gillnet						6.0	2	5.0	7.0	1.4
7	Filter net						1.0	2	0.7	1.3	0.4
8	Fish jig						3.5	68	0.0	30.0	4.0
9	Fish trap	3.8	58	0.0	20.0	3.8	6.4	16	0.0	25.0	7.5
10	Gleaning						2.9	1	2.9	2.9	
11	Handspear	3.3	44	0.3	7.8	2.0	3.8	209	0.0	30.0	4.4
12	Hook and line with float						4.5	5	0.9	12.0	4.4
13	Multiple handline	4.7	127	0.3	23.3	3.7	2.4	4	0.9	4.0	1.3
14	Octopus jig						3.6	26	0.0	13.9	3.6
15	Round haul seine	25.2	15	2.0	55.5	20.7					
16	Scoopnet	14.2	8	1.3	50.0	16.2	4.4	7	0.0	24.0	8.7
17	Set gillnet for rays						67.5	2	35.0	100.0	46.0
18	Set gillnet with plunger						3.1	29	0.0	23.0	4.0
19	Simple hook and line	9.7	565	0.6	43.1	7.0	5.8	34	0.0	23.0	6.1
20	Spear with compressor						15.0	8	5.0	37.4	10.0
21	Squid jig	1.2	70	0.1	11.0	1.7	3.8	6	1.0	7.0	2.3
22	Surface set longline						50.0	1	50.0	50.0	
23	Trammel net						4.9	15	0.0	25.0	6.2
24	Troll line						7.1	31	0.0	77.9	14.1

Table 11. Catch per unit effort (kg/day) of fishing gears monitored in selected landing sites in the South Negros MKBA during the fisheries baseline assessment conducted in 2013 and monitoring in 2015.

		2013					2015				
	Gear type	**CPUE**	**n**	**Min**	**Max**	**sd**	**CPUE**	**n**	**Min**	**Max**	**sd**
1	Bag net						600.0	4	100.0	1000.0	424.3
2	Bottom set gillnet	6.0	27	0.2	30.0	6.3	12.4	149	0.0	60.0	14.7
3	Bottom set longline						3.1	88	0.1	40.0	4.6
4	Cast net	1.2	1	1.2	1.2						
5	Crab pot	4.0	1	4.0	4.0						
6	Drift gillnet	19.7	6	4.0	39.0	12.3	27.8	78	0.0	400.0	57.2
7	Encircling gillnet						10.0	1	10.0	10.0	
8	Harpoon fishing with light	17.3	4	12.5	21.0	3.7					
9	Hook and line with float	96.9	42	1.5	294.0		20.0	111	0.0	82.0	19.5
10	Multiple handline						9.2	234	0.0	118.0	18.3
11	Ring net	1050.0	2	600.0	1500.0	636.4	437.1	31	1.2	1500.0	420.2
12	Scoopnet						8.5	2	2.0	15.0	9.2
13	Scoopnet with light	46.0	5	20.0	90.0	32.1	76.7	3	50.0	120.0	37.9
14	Seine net						2.0	1	2.0	2.0	
15	Simple hook and line	10.2	122	0.2	68.0	13.8	2.9	52	0.0	15.0	3.9
16	Spear						1.9	1	1.9	1.9	
17	Squid jig						4.1	19	0.1	20.0	6.1
18	Surface set longline						5.0	13	0.0	10.0	3.2
19	Troll line						3.0	30	0.0	8.0	2.6

Table 12. Catch per unit effort (kg/day) of fishing gears monitored in selected landing sites in the Surigao del Norte MKBA during the fisheries baseline assessment conducted in 2013 and monitoring in 2015.

				2013					2015		
	Gear type	CPUE	n	Min	Max	sd	CPUE	n	Min	Max	sd
1	Bag net	35.4	21	0.0	80.0	22.7	122.4	13	10.0	385.0	128.2
2	Barrier gillnet	3.7	11	0.9	9.7	2.7					
3	Beach seine	12.8	5	5.0	19.8	5.6					
4	Bottom set gillnet	3.8	330	0.0	87.0	6.1	4.5	430	0.2	58.6	6.3
5	Bottom set longline	3.6	252	0.4	20.0	2.6	8.7	539	0.6	45.1	5.8
6	Bottomset handline	3.9	70	0.0	17.1	4.2					
7	Crab gillnet	2.7	38	0.7	10.8	2.2	2.4	3	1.4	3.0	0.8
8	Crab liftnet	9.6	4	4.5	15.0	4.3					
9	Crab pot	2.8	123	0.3	9.0	1.6	2.7	75	0.3	7.9	1.6
10	Drag handline	12.9	19	3.3	22.5	6.1					
11	Drift gillnet	10.6	38	0.0	46.0	11.5	6.7	168	0.1	60.0	6.8
12	Drive-in gillnet	2.9	18	1.0	8.4	1.9	8.2	12	1.9	30.0	7.2
13	Dynamite						40.3	3	20.0	53.9	17.9
14	Encircling gillnet	15.5	2	5.0	26.0	14.8	8.2	15	1.6	32.8	9.2
15	Fish corral	1.2	9	0.0	4.0	1.3	20.8	1	20.8	20.8	
16	Fish jig	8.0	1	8.0	8.0						
17	Fish trap	4.1	15	0.3	11.6	3.4	4.9	7	1.1	18.0	6.0
18	Gleaning	4.2	1	4.2	4.2		5.9	1	5.9	5.9	
19	Hook and line with float	7.7	7	4.2	20.3	5.7					
20	Multiple handline	3.4	135	0.0	27.0	3.5	12.8	360	0.2	138.0	17.1
21	Round haul seine						5.0	4	1.3	8.0	2.8
22	Scoopnet with light						12.0	5	5.0	25.0	8.4
23	Seine net	1.5	1	1.5	1.5						
24	Set gillnet with plunger	5.8	5	2.0	10.0	2.9	8.4	3	2.3	18.0	8.4
25	Shark gillnet	5.5	1	5.5	5.5						
26	Simple hook and line	3.8	328	0.0	31.0	3.6	6.6	316	0.2	51.3	7.6
27	Spear	2.5	58	0.4	11.8	1.6	3.6	88	1.2	22.5	2.7
28	Spear with compressor	18.8	195	3.0	56.9	9.5	18.6	141	1.5	40.0	7.7
29	Squid gillnet	6.2	40	1.0	16.8	4.0	4.8	35	0.5	28.4	5.2
30	Squid jig	13.1	78	0.3	50.0	12.0	1.9	14	0.0	6.8	1.7
31	Squid trap	0.9	26	0.0	2.6	0.6	1.4	16	0.4	3.0	0.8
32	Trammel net	6.7	53	0.6	30.0	5.6	7.7	82	0.3	52.2	10.0
33	Troll line	11.2	63	2.8	37.2	8.3	8.3	15	1.1	40.9	11.6
34	Troll line for garfish	0.8	2	0.2	1.5	1.0					

Table 13. Catch per unit effort (kg/day) of fishing gears monitored in selected landing sites in the Tawi-Tawi MKBA during the fisheries baseline assessment conducted in 2013 and monitoring in 2015.

		2013					2015				
	Gear type	**CPUE**	**n**	**Min**	**Max**	**sd**	**CPUE**	**n**	**Min**	**Max**	**sd**
1	Bag net	0.6	3	0.5	0.8	0.2					
2	Barrier gillnet	6.6	25	1.8	16.0	3.8	12.8	49	5.5	62.0	8.3
3	Barrier net	6.4	17	2.4	10.5	2.3					
4	Beach seine	13.1	71	0.5	280.0	35.9	41.0	40	1.2	440.0	98.5
5	Bottom set gillnet	16.6	297	1.5	90.0	9.7	15.2	733	1.5	92.0	9.2
6	Bottom set longline	14.6	270	0.5	133.2	16.3	13.9	584	0.0	78.0	11.7
7	Crab gillnet	6.3	249	0.7	39.6	5.0	8.6	354	1.0	40.5	5.5
8	Crab liftnet	8.1	60	0.6	17.0	4.2	5.9	89	1.4	28.5	3.5
9	Diving						6.1	1	6.1	6.1	
10	Drag handline						7.9	11	0.3	26.7	7.8
11	Drift gillnet	9.8	13	1.4	40.0	11.6	25.1	13	1.4	42.0	13.3
12	Drive-in gillnet	25.1	28	1.0	90.0	22.8	31.6	10	5.6	65.0	19.6
13	Dynamite	32.2	300	0.5	1444.0	89.6	47.3	457	3.0	455.0	43.9
14	Encircling gillnet	55.0	21	3.0	160.0	44.2	41.3	28	16.0	150.0	27.1
15	Entrapping device	3.6	26	1.1	11.3	2.4					
16	Entrapping devices						4.8	27	0.4	16.3	3.4
17	Fish corral	7.6	21	0.5	19.7	5.5	20.2	41	3.1	37.0	7.5
18	Fish jig						9.0	4	1.1	25.0	11.0
19	Fish trap	10.0	181	1.5	30.0	4.5	13.1	88	1.4	40.0	9.8
20	Gleaning	2.6	30	0.6	10.3	2.3	6.4	124	1.5	90.0	8.8
21	Handspear	4.2	179	0.5	70.0	7.1	7.8	412	0.9	180.0	13.3
22	Hook and line with float	45.0	86	1.1	240.0	53.3	14.4	2	0.7	28.0	19.3
23	Lobster gillnet	17.1	195	1.5	180.0	18.8	23.8	75	1.4	50.0	7.6
24	Multiple handline	14.2	167	0.1	210.0	23.2	10.9	608	0.0	95.0	9.9
25	Octopus jig	4.9	127	0.0	17.0	2.7	14.8	370	1.8	82.0	16.5
26	Ring net	355.6	153	38.0	2660.0	423.6	198.5	106	35.0	1190.0	174.6
27	Scoopnet						25.1	2	0.2	50.0	35.2
28	Seine net	3.8	12	0.3	13.5	3.9	12.7	2	8.3	17.0	6.2
29	Set gillnet for rays	16.6	118	2.2	66.0	11.4	65.0	5	25.0	130.0	40.3
30	Set gillnet with plunger	3.5	8	0.4	8.0	3.1	9.0	52	1.3	31.6	5.0
31	Simple hook and line	3.9	579	0.0	45.0	3.7	10.6	552	0.0	95.0	13.3
32	Spear with compressor	11.8	17	1.2	58.5	15.1	58.1	123	1.0	138.0	23.7
33	Squid gillnet	12.2	15	6.1	27.0	5.6	16.4	34	5.8	30.0	5.6
34	Squid jig	4.8	9	0.9	10.0	4.1	4.6	248	0.0	30.0	4.6
35	Stationary liftnet	1.2	14	0.1	2.1	0.7	28.3	3	16.0	39.0	11.6
36	Surface set gillnet	22.6	102	3.0	103.3	14.2	33.7	272	12.0	105.0	11.8
37	Surface set longline	350.0	1	350.0	350.0						
38	Toxic substances	4.0	30	0.9	9.0	2.3	7.0	103	2.1	29.0	7.2
39	Troll line	13.0	459	0.0	95.0	13.8	33.0	1585	0.0	200.0	25.7

Table 14. Catch per unit effort (kg/day) of fishing gears monitored in landing sites in the Verde Island Passage MKBA during the fisheries baseline assessment conducted in 2013 and monitoring in 2015.

		2013					2015				
	Gear type	CPUE	n	Min	Max	sd	CPUE	n	Min	Max	sd
1	Bag net						79.9	10	0.0	400.0	117.8
2	Beach seine						35.3	6	2.0	80.0	37.3
3	Bottom set gillnet	44.3	118	3.0	200.0	34.7	4.1	10	0.0	10.0	2.7
4	Crab pot						3.0	1	3.0	3.0	
5	Drift gillnet	225.1	87	4.0	2800.0	364.3	48.3	68	0.0	300.0	62.6
6	Drive-in gillnet						500.0	10	40.0	1200.0	465.8
7	Fish corral	5.0	2	5.0	5.0	0.0					
8	Handspear	19.0	30	1.3	75.5	20.4					
9	Hook and line with float						0.8	3	0.2	2.0	1.0
10	Multiple handline	27.4	304	1.0	360.0	51.0	3.2	5	0.2	9.2	3.5
11	Purse seine						494.8	173	0.0	4800.0	810.5
12	Ring net	406.7	104	15.0	1500.0	299.6	436.2	973	0.0	6000.0	851.8
13	Set gillnet with plunger						3.6	17	1.0	12.0	2.6
14	Simple hook and line	6.2	112	0.5	50.0	7.2	6.1	179	0.0	70.0	10.6
15	Squid jig	90.0	4	89.0	91.0	1.2	4.0	43	0.0	20.5	3.9
16	Surface set longline						5.0	1	5.0	5.0	
17	Troll line						5.0	1	5.0	5.0	

3.1.2. MPA Baseline Assessment and Monitoring

Data and information gathered by the MPA baseline assessment teams included reef fish biomass, density, species richness, coral cover and other benthic forms. Details about the results were discussed in separate reports by the Monitoring teams from the University of the Philippines Visayas Foundation Inc. (UPVFI) and University of the Philippines Marine Science Institute's Marine Environment and Resources Foundation (MERF). The results, aside from being primarily used as one of the basis for measuring the project results, were likewise used to communicate with stakeholders the effects of management, in general, and the positive impacts of protection, in particular. This portion of the report, however, will just focus on an important set of information gathered to determine reef fish biomass.

Tables 15 to 22 summarizes the key parameters measured for each of the 8 MKBAs (such as mean reef fish biomass, their respective standard deviations, and number of replicates). Mean reef biomass ranged between 2 to 132 tons per square kilometer and was generally higher in the Verde Island Passage and Calamianes Island Group MKBAs and quite low in the Danajon Reef MKBA.

Table 15. Average reef fish biomass of selected MPAs in the Calamianes Island Group MKBA during the MPA baseline assessment conducted in 2013 and monitoring in 2015.

	2013			2015		
Marine Protected Area	Reef fish biomass ($tons/km^2$)	n	sd	Reef fish biomass ($tons/km^2$)	n	sd
Bugor	28.13	9	10.84	48.00	10	42.02
Royukan-Sagrado	21.30	8	12.06	56.08	10	35.71
Siete Pecados	41.19	10	18.14	50.69	10	44.93

Table 16. Average reef fish biomass of selected MPAs in the Danajon Reef MKBA during the MPA baseline asssessment conducted in 2013 and monitoring in 2015.

	2013			2015		
Marine Protected Area	Reef fish biomass ($tons/km^2$)	n	sd	Reef fish biomass ($tons/km^2$)	n	sd
Cuaming	11.48	10	6.18	8.27	10	3.10
Nasingin	7.19	10	3.81	8.52	10	4.90
Pangapasan	14.76	10	8.99	19.63	10	15.76

Table 17. Average reef fish biomass of selected MPAs in the Lingayen Gulf MKBA during the MPA baseline assessment conducted in 2013 and monitoring in 2015.

	2013			2015		
Marine Protected Area	Reef Fish Biomass ($tons/km^2$)	n	sd	Reef Fish Biomass ($tons/km^2$)	n	sd
Alaminos-Telbang	9.62	5	2.36	2.42	10	2.14
Canaoy/Kasay	10.80	9	3.32	7.81	10	4.82
Lingsat	21.44	4	5.47	20.9	8	8.45

Table 18. Average reef fish biomass of selected MPAs in the San Bernardino – Ticao Pass – Lagonoy Gulf MKBA during the MPA baseline assessment conducted in 2013 and monitoring in 2015.

	2013			2015		
Marine Protected Area	Reef Fish Biomass ($tons/km^2$)	n	sd	Reef Fish Biomass ($tons/km^2$)	n	sd
Bulan-Butag	7.00	10	4.99	10.82	10	8.26
Calintaan/Subic	20.36	8	13.56	20.38	8	13.09

Table 19. Average reef fish biomass of selected MPAs in the Southern Negros MKBA during the MPA baseline assessment conducted in 2013 and monitoring in 2015.

	2013			2015		
Marine Protected Area	Reef fish biomass ($tons/km^2$)	n	sd	Reef fish biomass ($tons/km^2$)	n	sd
Salag	35.83	2	2.39	20.30	2	6.26
Siit/Andulay	34.49	10	18.93	17.91	9	23.71
Tambobo	37.19	2	10.74	39.58	3	30.36

Table 20. Average reef fish biomass of selected MPAs in the Surigao del Norte MKBA during the MPA baseline assessment conducted in 2013 and monitoring in 2015.

	2013			2015		
Marine Protected Area	**Reef fish biomass (tons/km²)**	**n**	**sd**	**Reef fish biomass (tons/km²)**	**n**	**sd**
Nagubat	34.93	10	25.86	16.86	10	11.25
San Isidro	11.47	10	6.42	10.34	10	4.70
Tagana-an	16.78	10	9.81	28.01	10	48.25

Table 21. Average reef fish biomass of selected MPAs in the Tawi-Tawi MKBA during the MPA baseline assessment conducted in 2013 and monitoring in 2015.

	2013			2015		
Name of MPA	**Reef fish biomass (tons/km²)**	**n**	**sd**	**Reef Fish Biomass (tons/km²)**	**n**	**sd**
Batubatu-Kulape	14.27	10	8.53	29.43	10	25.33
Tunggusong-Maruwa	34.84	8	11.43	65.76	9	103.82
Ungos-Ungos	21.16	10	6.47	40.03	10	19.30

Table 22. Average reef fish biomass of selected MPAs in the Verde Island Passage MKBA during the MPA baseline assessment conducted in 2013 and monitoring in 2015.

	2013			2015		
Name of MPA	**Reef fish biomass (tons/km²)**	**n**	**sd**	**Reef Fish Biomass (tons/km²)**	**n**	**sd**
Bagong Silang	14.08	10	6.29	19.14	10	12.20
San Teodoro/Twin Tocks	60.10	8	30.05	58.10	8	20.72
Batalang Bato	63.60	9	40.53	57.49	8	54.86

3.2. Socio-Economic Baseline Assessment and Monitoring

There was a decrease in the number of households covered during the monitoring event in 2015 (Table 23). Out of 4,727 households in 2013, 3,982 remained in the fishing sector, representing a decrease of 16% in the sample size. The biggest decrease was in Surigao del Norte particularly in Gigaquit, followed by Danajon Reef, most of those leaving coming from Buenavista. In Calamianes, most of the respondents were still in the fishing sector, with only 7% leaving the sector by 2015.

The decrease in the sample size does not necessarily reflect that there is a net exit of fishers from the fisheries sector in general. For one thing, the survey does not account for possible entrants into the fisheries sector during the survey period. It only deals with the sample established when the baseline survey was conducted. Second, the general population of fishers has yet to be established from FishR, which started to be built on the same year that the baseline survey was conducted, and is still being built as of this writing. Hence, the proportion of the sample households to total fishing households could not be established yet. On this basis, statements on entries or exits from the fisheries sector are not being made. Rather, it is only stating that the sample size is now smaller, and the final target of 10% increase in employment (particularly with respect to indicators dealing directly with fish harvesting) will be measured only against the sample households that remain in the fisheries sector by project end. In Year 5, the survey will go back to those who exited the fisheries sector in Year 3 to find out if they have gone back to fishing or if they have exited for good. Reasons for their exit will be sought.

Table 23. Number of sample households in selected municipalities in the eight MKBAs surveyed during the baseline assessment in 2013 and monitoring in 2015.

MKBA	Municipality	Households surveyed		
		2013	2015	%Δ
Calamianes Island Group (CIG)	Busuanga	180	163	-9%
	Coron	182	170	-7%
	Culion	180	169	-6%
	Total	**542**	**502**	**-7%**
Danajon Reef (DB)	Tubigon	157	135	-14%
	Getafe	214	159	-26%
	Buenavista	243	152	-37%
	Inabanga	186	153	-18%
	Total	**800**	**599**	**-25%**
Lingayen Gulf (LG)	Alaminos	180	170	-6%
	Rosario	90	86	-4%
	San Fernando	233	177	-24%
	Total	**503**	**433**	**-14%**
San Bernardino Strait (SBTPLG)	Bulan	172	132	-23%
	Sta. Magdalena	183	169	-8%
	Capul	190	174	-8%
	Matnog	175	119	-32%
	Total	**720**	**594**	**-18%**
Southern Negros (SN)	Siaton	210	180	-14%
	Sta. Catalina	181	159	-12%
	Bayawan	153	126	-18%
	Total	**544**	**465**	**-15%**
Surigao del Norte (SDN)	Placer	200	154	-23%
	Bacuag	103	80	-22%
	Gigaquit	204	131	-36%
	Total	**507**	**365**	**-28%**
Sulu Archipelago (SA)	Panglima Sugala	180	176	
	Bongao	174	180	
	Simunul	183	181	
	Total	**537**	**537**	
Verde Island Passage (VIP)	Tingloy	187	132	-29%
	Mabini	196	179	-9%
	Calatagan	191	176	-8%
	Total	**574**	**487**	**-15%**
	Grand Total	**4,727**	**3,982**	**-16%**

The succeeding sections show the trends for each of the socio-economic components specified in the baseline assessment plan of the project.

3.2.1. Resource Use for Livelihoods

3.2.1.1. Household Income Sources

Households from all 7 MKBAs experienced declines from fin-fishing except for DB (Table 24). For sea cucumber collection, only SDN experienced an increase in average monthly incomes. In the tourism sector, LG had a large jump in average incomes, while both CIG and DB saw increases in average incomes from ornamental fish harvesting. All MKBAs with boat operation as a source of income had income increases on the average. Meanwhile, marine-based middlemen in South Negros had large increases in their average incomes. DB had the most number of income increases from marine-based livelihood activities.

There were more increases in average incomes from land-based livelihood activities of the sample fishing households. Incomes from farming of staple crops increased in SB, VIP, LG, CIG and SN, while those from vegetables increased in SDN, LG and SN (Table 25). Out of the 8 common sources, almost all MKBAs experienced average income increases in 5 of those sources.

As a result, less time has been devoted to marine-based livelihoods except in DB where average incomes increased (Table 24). Perceptions on increase or decrease of income relative to 2013 were not highly significant in all MKBAs.

Table 24. Average monthly incomes of marine-based livelihood activities in the eight MKBAs estimated during the survey conducted in 2015.

MKBA	Fin fishing				Sea cucumber collection				Other seafood collection			
	Income	%Δ	%	%Δ	Income	%Δ	%	%Δ	Income	%Δ	%	%Δ
CIG	4,900	-7%	87%	3%	1,657	-64%	4%	0%	4,667	54%	4%	0%
DB	6,589	10%	89%	-5%	1,461	-4%	2%	-7%	3,012	27%	10%	-8%
LG	3,085	-5%	83%	-15%	4,000	68%	1%	0%	2,678	138%	1%	-1%
SBTPLG	3,313	-6%	95%	-1%	1,565	-14%	2%	0%	1,016	-53%	3%	-1%
SN	4,128	-21%	93%	-6%	1,000	-79%	0%	-1%			0%	-1%
SDN	6,497	-34%	70%	-10%	2,500	69%	1%	0%	2,272	-68%	2%	-7%
SA	4,038		93%		1,763		10%		1,167		9%	
VIP	2,603	-13%	81%	-8%	1,625	-63%	1%	0%	1,119	49%	2%	0%

MKBA	Tourism		Ornamental fish		Boat operation		Middleman	
	Income	%Δ	Income	%Δ	Income	%Δ	Income	%Δ
CIG	6,750	-7%	4,861	18%	3,856	46%	12,467	48%
DB		-	4,800	118%	4,900	186%	5,375	2%
LG	5,000	400%	4,750	-	6,076	148%	6,500	-
SBTPLG	2,975	-54%		-100%	3,197	153%	6,000	26%
SN		-		-		-	10,000	449%
SDN		-	500	-95%	2,375	25%	2,000	-67%
SA		-	3,250		13,850		10,000	
VIP	4,700	-4%	2,000	0%	4,194	82%	2,000	-76%

MKBA	Aquaculture		Mangrove harvesting		Fish vendor		Seaweed	
	Income	%Δ	Income	%Δ	Income	%Δ	Income	%Δ
CIG		-	1,838	-1%		-	5,094	98%
DB		-		-	4,190	104%	2,825	15%
LG		-		-	1,792	-31%		-
SBTPLG		-	6,250	-	2,400	18%	4,167	245%
SN		-	5,000	-	2,442	14%		-
SDN	6,500	-35%		-100%	5,500	-39%		-
SA		-		-	3,938		6,174	
VIP		-		-	2,946	-62%	1,150	-

Table 25. Average monthly incomes of land-based livelihood activities in the eight MKBAs estimated from surveys conducted in 2015.

MKBA	Farming staple crops		Farming vegetables		Retail		Self-employed	
	Income	%Δ	Income	%Δ	Income	%Δ	Income	%Δ
CIG	4,329	57%	1,343	-24%	5,718	5%	2,949	-65%
DB	2,264	-11%	1,613	-9%	3,507	4%	2,664	114%
LG	15,250	152%	4,750	138%	3,425	16%	4,135	19%
SBTPLG	2,109	12%	656	-51%	3,201	16%	2,808	15%
SN	6,540	56%	3,499	9%	1,835	-43%	1,580	-27%
SDN	4,930	-63%	3,667	179%	2,687	-21%	7,917	217%
SA	3,631		1,792		2,237		1,804	
VIP	2,976	39%	896	-59%	2,963	50%		-100%

MKBA	Government		4Ps		Privately employed		Livestock	
	Income	%Δ	Income	%Δ	Income	%Δ	Income	%Δ
CIG	2,920	-54%	2,700	90%	6,114	86%	4,983	158%
DB	3,072	13%	2,170	19%	4,637	-60%	-	-100%
LG	12,470	160%	2,275	-	8,324	-47%		-
SBTPLG	4,230	3%	2,642	-	4,292	96%	2,000	-82%
SN	4,091	-22%	2,000	7%	5,900	71%	2,350	9%
SDN	9,441	40%	1,134	-29%	6,500	84%	8,667	129%
SA	5,083				1,600			-
VIP	6,409	52%	1,062	-52%	8,148	-36%	6,500	53%

MKBA	Laborers		Househelp		Driver	
	Income	%Δ	Income	%Δ	Income	%Δ
CIG	4,298	21%	4,270	128%	12,417	-
DB	1,818	-52%	2,017	-18%	3,633	42%
LG	4,945	22%	7,313	154%	3,450	36%
SBTPLG	2,232	-24%	3,073	28%	2,108	-14%
SN	3,025	77%	2,472	51%	2,626	74%
SDN	2,805	-12%	2,750	36%	2,750	-54%
SA	4,191		1,091		500	
VIP	3,810	18%	2,623	11%	3,146	-34%

Table 26. Comparison of marine-based livelihood incomes relative to two years ago in the eight MKBAs estimated from surveys conducted in 2015.

MKBA	Fin Fishing							
	Mos.		Comparison					
			Less		More		No Change	
	2015	%Δ	2015	%Δ	2015	%Δ	2015	%Δ
CIG	7	-11%	68%	12%	2%	0%	16%	-10%
DB	11	4%	69%	8%	2%	-5%	16%	-8%
LG	8	-6%	56%	3%	6%	1%	19%	-19%
SBTPLG	8	10%	32%	-10%	2%	-4%	49%	1%
SN	8	-34%	35%	-16%	23%	17%	35%	-6%
SDN	9	-18%	30%	-17%	8%	-4%	24%	10%
SA	9		33%		10%		43%	
VIP	7	-11%	32%	-16%	14%	9%	25%	7%

MKBA	Sea Cucumber Collecting							
	Mos.		Comparison					
			Less		More		No Change	
	2015	%Δ	2015	%Δ	2015	%Δ	2015	%Δ
CIG	7	-19%	3%	-1%		0%	0%	0%
DB	11	28%	1%	-5%	0%	-1%	0%	0%
LG	11	83%	0%	0%	0%	0%	0%	0%
SBTPLG	6	-17%	1%	0%	0%	0%	1%	0%
SN	10	-17%	0%	0%	0%	0%	2%	2%
SDN	12	0%	0%	0%	0%	0%	0%	-1%
SA	7		1%		0%			
VIP			0%	-1%	0%	0%	0%	0%

MKBA	Other Seafood Collection							
	Mos		Comparison					
			Less		More		No Change	
	2015	%Δ	2015	%Δ	2015	%Δ	2015	%Δ
CIG	6	-39%	2%	1%	0%	0%	1%	1%
DB	10	8%	6%	-6%	0%	-2%	3%	-1%
LG	11	70%	0.2%	-2%	0.2%	0%	1%	0%
SBTPLG	6	-6%	1%	0%	0%	0%	1%	-1%
SN		-100%		0%		0%		-1%
SDN	9	-19%	1%	-4%	0%	0%	0%	-4%
SA	7		2%		0.4%		7%	
VIP	6		0%	-1%	0%	0%	1%	0%

3.2.1.2. Household Expenditures

Food continues to dominate household expenses in all MKBAs (Table 27). In five project sites, food still comprises more than half of the household's expenses. School expenditures are usually the second largest expense item, except in VIP, LG and SN where households spend more for house repairs and fuel expenses, respectively. In VIP, microfinancing has also become a major expense item in the sample fishing households.

Table 27. Household expenditures in the eight MKBAs estimated during the survey conducted in 2015.

MKBA	Largest expense item		% of total expenses	2nd largest expense item		% of total expenses	3rd largest item		% of total expenses
	2013	2015		2013	2015		2013	2015	
CIG	Food	Food	57	School expenditures	School expenditures	10	Clothing	House repairs	9
DB	Food	Food	62	Debts, interest payments	School expenditures	9	School expenditures	Fuel expenses	6
LG	Food	Food	64	School expenditures	Fuel expenses	9	Monthly paid services	School expenditures	8
SBTPLG	Food	Food	66	School expenditures	School expenditures	11	Clothing	Fuel expenses	6
SN	Food	Food	60	School expenditures	Fuel expenses	13	Transportation expenses	School expenditures	8
SDN	Food	Food	34	School expenditures	School expenditures Recreational items	10	Debts, interest payments	Fuel expenses	8
SA		Food	30		School expenditures	11		Recreational items, Transportation expenses	9
VIP	Food	Food	25	School expenditures	House repairs	13	House repairs, Debts	School expenditures, Microfinancing	9

3.2.1.3. Profile of the Fishing Households Surveyed

There was a general decline of the number of municipal fishers in all categories (Table 28). There were more fishers with no boats in most MKBAs except SB and DB, although the increases were not significant. The decrease in the number of fishers with non-motorized and motorized boats was more significant in most MKBAs, except in SB and DB. Only CIG had an increase in the number of municipal fishers with non-motorized boats. Among commercial fishers of the sample, SDN had a drastic reduction in number, down by 24% relative to 2013 figures.

Fishing patterns saw changes in many cases. For five MKBAs, average hours per trip were lower, except in CIG, DB and SN where hours of fishing increased (Table 29). In terms of travel time to fishing grounds, only SB, CIG and SN had increased travel time, with the others experiencing less time to get to their fishing grounds. More people are now involved in fishing in SB, SDN and DB. Furthermore, there are significantly more fishing trips in a month in SB, VIP, CIG and SN. Both CIG and SN likewise recorded more months of fishing in a year. On the whole, CIG and SN had increased fishing intensity relative to the baseline data of 2013.

3.2.1.4. Fishing Revenues and Expenditures

In general, revenues from fishing increased. There were some gainers and losers in the project MKBAs, but on the whole, commercial fishers gained the most (Table 30). For those with non-motorized boats, only VIP and LG had lower revenues. On the other hand, those with motorized boats had lower revenues in general, except in SDN and VIP. In LG, all types of fishers recorded lower revenues, while in SDN, all types of fishers had higher revenues.

Table 28. Percentage of municipal versus commercial fishers in the sampled households during the survey conducted in 2015.

MKBA	Municipal						Commercial	
	No Boat		With Boat					
			Non-Motorized		Motorized			
	2015	%Δ	2015	%Δ	2015	%Δ	2015	%Δ
CIG	1.2%	1.2%	27%	5.7%	61%	-15.8%	1%	-1.2%
DB	1.2%	-1.8%	41%	-1.6%	55%	-1.2%	0%	-1.0%
LG	2.3%	2.3%	16%	-6.3%	53%	-18.2%	0%	-5.0%
SBTPLG	0.3%	-3.7%	40.2%	0.2%	27%	-1.2%	0.3%	0.0%
SN	0.4%	0.4%	33%	-5.3%	46%	-1.0%	5%	-4.3%
SDN	0.3%	0.3%	30%	-6.7%	21%	-9.5%	1%	-23.8%
SA	-		42%		46%		1%	
VIP	1.4%	0.4%	21%	-7.8%	45%	-16.5%	11%	2.9%

Table 29. Fishing pattern of fishers in the fishing household sampled during the survey conducted in 2015.

MKBA	Average hours per trip		Average travel time to fishing ground (minutes)		Number of persons involved per trip		Average trips per month		Average number of months per year	
	2015	%Δ	2015	%Δ	2015	%Δ	2015	%Δ	2015	%Δ
CIG	23	7%	96	39%	2	-5%	18	29%	10	10%
DB	7	18%	32	-15%	2	5%	24	-6%	11	-2%
LG	6	-15%	52	-33%	2	-8%	19	-14%	9	-15%
SBTPLG	5	-4%	51	24%	3	23%	21	20%	7	-12%
SN	46	30%	177	65%	3	-17%	18	61%	10	17%
SDN	11	-56%	84	-63%	3	35%	14	-6%	9	-17%
SA	8		58		2		21		9	
VIP	5	-74%	53	-38%	3	-1%	21	27%	8	-12%

On the other hand, average costs in fishing increased significantly (Table 31). Figures for non-motorized fishing boats increased for most MKBAs, with VIP increasing by 68%. LG and CIG had lower costs. For motorized fishing boats, VIP had more than tripled costs relative to 2013, and SB had over 50% increase in average costs. For commercial fishers, costs increased significantly.

Combining revenues and costs figures shows that net profit increased for most MKBAs (Table 32). Non-motorized boats had larger revenues, particularly in ST, CIG, and SN, and slight increases in VIP. Motorized boats though had lower net profits for most MKBAs except VIP, CIG and SN. The commercial fishing sector exhibited extremely higher net profits in all MKBAs that had commercial fishers in the sample. VIP, CIG and SN fishers had higher average net profits for all types of fishers, while LG and DB fishers had lower net profits for all types of fishers.

Table 30. Average annual revenues per fishing household in the eight MKBAs estimated during the survey conducted in 2015 (NM – non-motorized boats, M - motorized boats, C – commercial vessels).

MKBA	NM		M		C	
	2015	%Δ	2015	%Δ	2015	%Δ
CIG	87,918	52%	122,590	-28%	577,800	517%
DB	67,893	26%	98,180	-18%	-	-
LG	57,234	-26%	145,145	-24%	-	-
SBTPLG	147,608	88%	123,769	-6%		
SN	109,628	196%	102,356	-52%	3,029,135	2047%
SDN	68,820	3%	107,365	5%	5,750,100	1474%
SA	123,066		156,211		603,595	
VIP	59,543	-21%	142,958	6%	7,737,529	1704%

Table 31. Average annual cost per fishing household in the eight MKBAs estimated during the survey conducted in 2015 (NM – non-motorized boats, M - motorized boats, C – commercial vessels).

MKBA	Total Costs (PhP)					
	NM		M		C	
	2015	%Δ	2015	%Δ	2015	%Δ
CIG	42,507	-27%	102,186	-8%	204,145	88%
DB	50,056	68%	85,499	20%	-	-
LG	42,071	-24%	139,565	27%	-	-
SBTPLG	34,528	16%	56,536	52%		
SN	70,103	44%	227,484	-4%	4,357,568	2419%
SDN	74,193	41%	69,781	-40%	1,314,696	269%
SA	131,427		195,613		2,092,325	
VIP	103,297	33%	647,111	339%	713,649	218%

Table 32. Average annual profit per fishing household in the eight MKBAs estimated during the survey conducted in 2015.

MKBA	NM		M		C	
	2015	%Δ	2015	%Δ	2015	%Δ
CIG	43,313	108%	77,451	180%	412,200	3260%
DB	33,241	-25%	44,641	-19%	-	-
LG	24,040	-37%	66,848	-13%	-	-
SBTPLG	119,510	96%	79,298	-15%		
SN	68,904	482%	79,968	65%	1,429,912	1408%
SDN	(1,437)	-103%	40,323	-37%	4,435,404	1799%
SA	56,651		52,501		38,167	
VIP	49,948	22%	74,046	11%	6,805,752	2311%

3.2.2. Socio-Demographic Profile

More households are consuming seafood everyday, although majority of sample respondents indicated no change in the frequency of seafood consumption compared to the baseline year (Table 33).

Table 33. Seafood consumption of fishing households relative to two years ago in the eight MKBAs estimated from surveys conducted in 2015.

MKBA	Everyday consumption of seafood 2015	%Δ	Frequency compared to 2 years ago 2015	%Δ
CIG	81%	4%	No Change (58%)	-12%
DB	79%	8%	No Change (54%)	4%
LG	69%	4%	No Change (65%)	5%
SBTPLG	63%	1%	No Change (63%)	8%
SN	77%	6%	No Change (62%)	-10%
SDN	52%	-1%	No Change (53%)	-7%
SA	92%		No Change (71%)	
VIP	62%	-12%	No Change (73%)	-13%

3.2.3. CRM-Related Perceptions of Fishing Households

More households believe they are increasingly being exposed to tropical storms in most MKBAs, particularly in CIG which experienced the wrath of Yolanda in December 2013 (Table 34). However, less households now believe they are exposed to storm surges, coastal erosion, saltwater inundation, floods (except for SB households) and landslides. DB households are now more conscious of earthquakes, given the Bohol earthquake experience in 2013.

In terms of improved conditions of marine resources, only SDN and SN households indicated positive trends. For all five components of marine resources measured, more SDN and SN households indicated better conditions relative to the trend of those indicating they were getting worse. The opposite can be said for VIP, LG and DB households, wherein there were less households who perceive the situation is getting better, and more households who think they are getting worse (Table 35).

More households in SB, CIG and SN now believe that population has no impact on conditions of marine resources (Table 36), while in SDN, VIP, LG, DB and SN, there is also an increasing trend of households believing that population has a negative impact. More VIP households believe that coastal development has negative impacts (Table 37), and more SDN, VIP, LG and SN households believe in the negative impacts of pollution (Table 38). Destructive fishing methods and commercial fishing encroachment are now recognized as negatively impacting the environment by more households across all MKBAs (Tables 39 and 40), along with the lack of monitoring activities in the marine environment (Table 41).

Awareness and knowledge about MPAs and the accompanying benefits seemed to have improved only in SB MKBA (Table 42). Acknowledgement of MPA management improved in SB and CIG MKBAs though, and support for MPA initiatives increased among SB, CIG and SN households.

Overall, there is an improved awareness and recognition on the threats to the marine environment in all project MKBAs. There are still negative perceptions on the conditions of the marine environment though, indicating that there is still room for improvement in addressing the threats, thereby improving the condition of marine resources. Along with this, there seems to be a decrease in MPA awareness, and expressed support improved in only 3 MKBAs.

Table 34. Perceptions on exposure to natural disaster by fishing households in the eight MKBAs.

MKBA	Tropical storm	%∆	Storm surge	%∆	Coastal erosion	%∆	Saltwater inundation	%∆
CIG	83%	11%	16%	-38%	2%	-18%	10%	-21%
DB	98%	6%	2%	-14%	1%	-7%	35%	-1%
LG	97%	1%	10%	-22%	1%	-5%	3%	-8%
SBTPLG	94%	-1%	41%	13%	17%	4%	13%	-5%
SN	88%	-1%	13%	-16%	7%	3%	10%	-4%
SDN	80%	8%	38%	11%	19%	11%	35%	19%
SA	19%		20%		2%		2%	
VIP	94%	5%	20%	-12%	1%	-8%	6%	-5%

MKBA	Floods	%∆	Land /Mud slide	%∆	Brush fire	%∆	Earth-quake	%∆	Strong winds	%∆
CIG	1%	-8%	4%	-4%	2%	-3%				
DB	18%	4%	1%	1%		0%	46%	45%		
LG	10%	-8%	1%	0%		0%				
SBTPLG	34%	8%	3%	2%	1%	1%				
SN	22%	0%	2%	0%				-3%	7%	2%
SDN	39%	-1%	2%	-8%						
SA	3%		8%							
VIP	15%	-2%	2%	-3%		-1%				

Table 35. Perceptions on relative condition of marine resources by fishing households relative to two years ago in the eight MKBAs estimated from surveys conducted in 2015.

MKBA	Live coral cover				Fish abundance				Fish size			
	%∆ Better	%∆ Worse	%∆ No change	%∆ Don't know	%∆ Better	%∆ Worse	%∆ No change	%∆ Don't know	%∆ Better	%∆ Worse	%∆ No change	%∆ Don't know
CIG	-2%	0%	-5%	4%	-6%	-13%	15%	2%	-9%	-5%	10%	4%
DB	-12%	20%	-4%	-6%	-2%	10%	-10%	1%	-1%	4%	-7%	2%
LG	-3%	5%	-6%	-4%	-6%	-4%	-2%	1%	-4%	4%	-14%	2%
SBTPLG	-4%	-18%	11%	2%	-5%	-3%	-2%	6%	-3%	-1%	2%	6%
SN	7%	2%	25%	-1%	7%	3%	-6%	1%	7%	-10%	-3%	5%
SDN	15%	-21%	3%	2%	14%	-27%	7%	4%	5%	-44%	0%	4%
SA												
VIP	-4%	25%	-9%	-12%	-6%	12%	-8%	1%	-4%	18%	-17%	2%

MKBA	Fish diversity				Water quality			
	%∆ Better	%∆ Worse	%∆ No change	%∆ Don't know	%∆ Better	%∆ Worse	%∆ No change	%∆ Don't know
CIG	-8%	-1%	3%	2%	3%	12%	-13%	6%
DB	-2%	-16%	1%	14%	7%	9%	-19%	9%
LG	-6%	5%	-11%	2%	-6%	-10%	-6%	5%
SBTPLG	-2%	2%	6%	-3%	-6%	-4%	10%	-1%
SN	9%	-14%	7%	-3%	-1%	-5%	0%	-8%
SDN	0%	-25%	6%	4%	9%	-17%	2%	2%
SA								
VIP	-7%	24%	-20%	2%	-4%	26%	-28%	1%

Table 36. Perceived impact of population growth by fishing households in the eight MKBAs measured from surveys conducted in 2015.

MKBA	%Δ Very Negative	%Δ Negative	%Δ No impact	%Δ Positive	%Δ Very Positive	%Δ Don't know
CIG	-4%	4%	14%	-19%	12%	8%
DB	1%	10%	-6%	3%	-1%	-10%
LG	13%	1%	-2%	-21%	-1%	0%
SBTPLG	-3%	-10%	18%	3%	-1%	0%
SN	13%	11%	13%	-16%	-7%	-16%
SDN	2%	13%	1%	-9%	-5%	3%
SA						
VIP	5%	24%	-18%	-16%	0%	-1%

Table 37. Perceived Impact of Coastal Development by Fishing Households in the Eight MKBAs Measured from Surveys Conducted in 2015.

MKBA	%Δ Very Negative	%Δ Negative	%Δ No impact	%Δ Positive	%Δ Very Positive	%Δ Don't know
CIG	-2%	-19%	10%	1%	-1%	10%
DB	3%	0%	4%	0%	1%	-12%
LG	0%	7%	-14%	-10%	3%	4%
SBTPLG	-1%	-11%	-2%	16%	-1%	-1%
SN	10%	-5%	7%	-2%	3%	-12%
SDN	-2%	3%	-10%	20%	-1%	-6%
SA						
VIP	3%	26%	-20%	-16%	0%	2%

Table 38. Perceived impact of pollution by fishing households in the eight MKBAs measured from surveys conducted in 2015.

MKBA	%Δ Very negative	%Δ Negative	%Δ No impact	%Δ Positive	%Δ Very positive	%Δ Don't Know
CIG	-9%	-4%	5%	-4%	1%	4%
DB	-8%	1%	2%	0%	1%	1%
LG	-4%	16%	-2%	-16%	-6%	3%
SBTPLG	-2%	7%	-1%	4%	0%	0%
SN	25%	-2%	17%	-17%	-11%	-14%
SDN	28%	-10%	-5%	-8%	-5%	-1%
SA						
VIP	-3%	30%	-4%	-21%	-5%	2%

Table 39. Perceived impact of destructive fishing by fishing households in the eight MKBAs measured from surveys conducted in 2015.

MKBA	%Δ Very negative	%Δ Negative	%Δ No impact	%Δ Positive	%Δ Very positive	%Δ Don't Know
CIG	14%	3%	2%	-17%	2%	3%
DB	-28%	28%	-1%	-2%	1%	1%
LG	0%	21%	-4%	-17%	-6%	-1%
SBTPLG	-11%	17%	2%	1%	-1%	0%
SN	36%	-11%	10%	-13%	-5%	-25%
SDN	27%	-4%	-2%	-11%	-5%	-3%
SA						
VIP	-10%	18%	0%	-6%	1%	3%

Table 40. Perceived impact of commercial fishing encroachment by fishing households in the eight MKBAs measured from surveys conducted in 2015.

MKBA	%∆ Very negative	%∆ Negative	%∆ No impact	%∆ Positive	%∆ Very positive	%∆ Don't Know
CIG	18%	-9%	9%	-12%	-2%	6%
DB	6%	-8%	-4%	-2%	0%	4%
LG	-1%	16%	-3%	-15%	-5%	-2%
SBTPLG	-1%	9%	0%	-1%	0%	-13%
SN	15%	5%	14%	-12%	-4%	-19%
SDN	3%	19%	-3%	-14%	-3%	-1%
SA						
VIP	-4%	21%	1%	-15%	-2%	4%

Table 41. Perceived impact of lack of monitoring by fishing households in the eight MKBAs measured from surveys conducted in 2015.

MKBA	%∆ Very negative	%∆ Negative	%∆ No impact	%∆ Positive	%∆ Very positive	%∆ Don't Know
CIG	15%	-14%	2%	-9%	-1%	6%
DB	8%	-4%	-3%	-8%	5%	0%
LG	0%	10%	0%	-15%	-4%	0%
SBTPLG	-6%	10%	2%	1%	-0.70%	0%
SN	17%	9%	2%	-7%	-9%	-15%
SDN	13%	14%	-4%	-19%	-2%	-1%
SA						
VIP	-3%	18%	0%	-12%	0%	2%

Table 42. Perception on marine protected areas by fishing households in the eight MKBAs measured from surveys conducted in 2015.

MKBA	Know MPA?		Improved due to MPA?		Less illegal fishing?		Management Functional		Sustainable?		Will you support MPA?	
	2015	%∆	2015	%∆	2015	%∆	2015	%∆	2015	%∆	2015	%∆
CIG	65%	14%	56%	-6%	44%	-5%	53%	9%	66%	4%	82%	15%
DB	84%	-8%	55%	-14%	34%	-17%	56%	-16%	60%	-19%	82%	-6%
LG	28%	-13%	15%	-20%	16%	-19%	15%	-17%	16%	-16%	24%	-12%
SBTPLG	24%	13%	20%	14%	24%	21%	19%	17%	27%	22%	51%	25%
SN	3%	-6%	2%	-3%	2%	-3%	5%	-1%	10%	4%	16%	8%
SDN	33%	-9%	22%	-3%	18%	-1%	18%	-4%	22%	-8%	35%	-7%
SA	41%		39%		38%		35%		32%		37%	
VIP	21%	-7%	15%	-10%	14%	-10%	15%	-9%	15%	-9%	16%	-18%

Table 43. Perception by fishing households in the eight MKBAs on the probability of detection, arrest, prosecution and conviction of illegal fishers.

MKBA	Detection		Arrest		Prosecution		Conviction		Recidivism		Bantay dagat score	
	2015	%∆	2015	%∆	2015	%∆	2015	%∆	2015	%∆	2015	%∆
CIG	6	50%	6	50%	6	100%	6	50%	7	17%	6	50%
DB	5	-17%	5	0%	5	0%	7	17%	8	14%	5	-29%
LG	4	-20%	4	-20%	4	-20%	4	-20%	6	0%	5	-17%
SBTPLG	7	40%	7	40%	6	50%	6	20%	7	17%	5	25%
SN	6	0%	6	0%	6	0%	6	-14%	6	-14%	5	25%
SDN	6	20%	7	40%	8	60%	8	33%	8	0%	6	20%
SA	6		6		6		6		6		6	
VIP	4	-33%	5	-17%	5	-17%	5	-17%	5	-29%	5	-17%

3.3. Measuring Project Results A and B

As mentioned earlier, at the end of five years, the ECOFISH Project is expected to achieve two key results:

(A) An average of 10% increase in fisheries biomass across the eight MKBAs, and
(B) A 10% increase in the number of people gaining employment or better employment from sustainable fisheries management from a baseline established at the start of the project.

This Year 3 monitoring event provided insights into the process of measuring the project key results at the midstream and allow the team to make modifications and refinement to further improve, not just the results on itself, but also on the accuracy of data collection and calculation of parameters for the final monitoring event in 2017.

3.3.1. Measuring Project Result A Using Fisheries and MPA Assessment Tools

During the Year 3 monitoring event, fisheries and MPA assessment activities, similar to those conducted in Year 1, were performed. ECOFISH Project Result A (an average of 10% increase in fisheries biomass across the eight MKBAs) were estimated from the combined result of change in catch rates of selected fishing gears and change in reef fish biomass in selected MPAs.

The catch rates were based on the average catch per unit effort (CPUE) of selected fishing gears in the focal areas. The average CPUE is the proxy estimate of fish biomass. The computation involved the estimation of percentage change in CPUE during the monitoring event (2015) compared to the baseline (2013) using fisheries dependent methods. The average CPUE were estimated from the weighted average of catch per unit effort of various fishing gears used during the 3-month catch and effort monitoring using the number of samples as weighing factor. Table 44 summarize the catch rates of various fishing gears encountered in the fisheries dependent survey in the focal areas of the 8 MKBAs and the estimated average percent change relative to the 2013 base year.

The second component is the change in reef fish biomass. Baseline assessments in 2013 were conducted in selected MPAs in the focal areas of the 8 MKBAs followed by the first monitoring event in 2015. Table 45 summarizes estimates of reef fish biomass, the average percent change relative to the results during 2013 baseline assessment.

Table 46 shows the computed weighted average percent change for both CPUE and reef fish biomass per MKBA, and the weighted average percent change in for the eight MKBAs. For the Project Key Result A, the percentage increase (average of the 4 MKBAs) in fisheries biomass (ΔB) is 5.95%. The increase came mainly from MPAs. Six of the 8 MKBAs registered positive reef fish biomass results while increase in catch rates were achieved only 4 of the 8 MKBAs. A major factor was the timing of the fish catch monitoring. The Year 3 catch monitoring event was conducted 3 to 4 months ahead of schedule to coincide with the scheduled midterm evaluation of the project. This inaccuracy can be rectified by reverting back to the original schedule in the coming Year 5 and final monitoring event.

Table 44. Average catch per unit effort (CPUE), in kg/day, of fishing gears in the eight MKBAs during the fisheries baseline assessment conducted in 2013 and monitoring in 2015.

	2013		2015	
MKBA/Fishing Gear	**CPUE**	**n**	**CPUE**	**n**
Calamianes Island Group				
Bag net	228.38	129	155.26	88
Bottom set gillnet	9.53	665	13.61	256
Bottom set longline	9.41	402	9.34	208
Crab pot	5.00	1	3.90	10
Drift gillnet	13.70	110	15.60	57
Encircling gillnet	7.67	7	7.54	6
Fish corral	9.97	39	15.26	5
Fish trap	6.82	31	9.41	11
Gleaning	2.65	10	7.66	13
Multiple handline	3.12	305	4.02	169
Scoopnet with light	3.30	1	1.49	20
Set gillnet with plunger	19.48	15	10.48	38
Simple hook and line	3.31	250	6.14	98
Spear	13.92	52	6.79	37
Spear with compressor	20.38	135	20.45	12
Squid jig	1.63	12	2.74	71
Trammel net	10.04	96	11.87	145
Troll line	18.40	268	13.33	130
Average % change			**19.71**	
Danajon Reef				
Bottom set gillnet	1.84	567	2.27	1888
Bottom set longline	4.53	542	5.24	790
Crab gillnet	1.81	502	1.61	861
Crab pot	2.58	125	2.74	511
Danish seine	10.81	86	21.99	128
Diving	4.23	79	2.67	341
Drag handline	18.17	87	17.85	163
Drift gillnet	22.94	203	14.02	284
Drive-in gillnet	30.46	42	5.44	45
Dynamite	14.34	16	9.31	91
Fish corral	2.41	245	3.41	635
Fish trap	5.96	62	2.43	10
Hook and line with float	2.93	30	2.56	5
Multiple handline	2.61	265	1.95	527
Push/Scissor net	3.16	9	1.25	16
Ring net	546.41	82	203.80	46
Seine net	6.52	48	11.75	97
Set gillnet with plunger	6.24	25	2.90	28
Simple hook and line	2.19	248	1.99	404
Spear	4.07	127	1.40	356
Spear with compressor	26.02	222	25.13	58
Squid gillnet	6.77	127	9.17	93
Squid jig	1.34	27	1.40	114
Trammel net	7.69	62	2.60	36
Troll line	3.04	32	2.70	163
Average % change			**1.29**	
Lingayen Gulf				
Bottom set gillnet	4.20	385	2.55	351
Fish trap	3.16	17	14.23	7
Multiple handline	16.78	174	5.70	167
Average % change			**-39.06**	
San Bernardino Strait				
Bottom set gillnet	18.09	182	20.01	246
Bottom set longline	10.00	1	17.42	110
Crab gillnet	5.29	37	4.47	11
Drift gillnet	39.57	208	14.61	69
Fish trap	3.83	58	6.43	16
Handspear	3.26	44	3.85	209
Multiple handline	4.75	127	2.38	4
Scoopnet	14.22	8	4.42	7
Simple hook and line	9.71	565	5.79	34
Squid jig	1.24	70	3.75	6
Average % change			**-6.13**	
South Negros				
Bottom set gillnet	6.00	27	12.35	149
Drift gillnet	19.67	6	27.77	78
Hook and line with float	96.88	42	19.97	111
Ring net	1050.00	2	437.10	31
Scoopnet with light	46.00	5	76.67	3
Simple hook and line	10.15	122	2.90	52
Average % change			**-7.12**	
Surigao del Norte				
Bag net	35.44	21	122.41	13
Bottom set gillnet	3.81	330	4.49	430
Bottom set longline	3.56	252	8.71	539
Crab gillnet	2.70	38	2.41	3
Crab pot	2.79	123	2.70	75
Drift gillnet	10.65	38	6.74	168
Drive-in gillnet	2.92	18	8.19	12
Encircling gillnet	15.50	2	8.17	15
Fish trap	4.11	15	4.94	7
Multiple handline	3.43	135	12.80	360
Simple hook and line	3.81	328	6.58	316
Spear	2.50	58	3.65	88
Spear with compressor	18.84	195	18.62	141
Squid gillnet	6.21	40	4.84	35
Squid jig	13.08	78	1.90	14
Squid trap	0.86	26	1.40	16
Trammel net	6.68	53	7.72	82
Troll line	11.20	63	8.33	15
Average % change			**75.96**	
Sulu Archipelago				
Barrier gillnet	6.57	25	12.77	49
Beach seine	13.08	71	41.04	40
Bottom set gillnet	16.64	297	15.22	733
Bottom set longline	14.56	270	13.94	584
Crab gillnet	6.26	249	8.61	354
Crab liftnet	8.11	60	5.87	89
Drift gillnet	9.80	13	25.11	13
Drive-in gillnet	25.14	28	31.58	10
Dynamite	32.21	300	47.29	457
Encircling gillnet	55.05	21	41.29	28
Fish corral	7.65	21	20.17	41
Fish trap	9.98	181	13.09	88
Gleaning	2.58	30	6.37	124
Handspear	4.25	179	7.81	412
Hook and line with float	45.04	86	14.35	2
Lobster gillnet	17.07	195	23.82	75
Multiple handline	14.19	167	10.87	608
Octopus jig	4.86	127	14.79	370
Ring net	355.61	153	198.54	106
Seine net	3.83	12	12.65	2
Set gillnet for rays	16.60	118	65.00	5
Set gillnet with plunger	3.51	8	8.98	52
Simple hook and line	3.85	579	10.57	552
Spear with compressor	11.79	17	58.06	123
Squid gillnet	12.17	15	16.41	34
Squid jig	4.78	9	4.61	248
Stationary liftnet	1.23	14	28.33	3
Surface set gillnet	22.59	102	33.72	272
Toxic substances	4.04	30	7.02	103
Troll line	13.02	459	32.96	1585
Average % change			**84.03**	
Verde Island Passage				
Bottom set gillnet	44.32	118	4.10	10
Drift gillnet	225.10	87	48.27	68
Multiple handline	27.37	304	3.17	5
Ring net	406.73	104	436.20	973
Simple hook and line	6.23	112	6.12	179
Squid jig	90.00	4	4.02	43
Average % change			**-22.36**	

Table 45. Average reef fish biomass (RFB), in tons/km^2, of MPAs in the eight MKBAs during the MPA baseline assessment conducted in 2013 and monitoring in 2015.

	2013		2015			2013		2015	
MKBA/MPA	**RFB**	**n**	**RFB**	**n**	**MKBA/MPA**	**RFB**	**n**	**RFB**	**n**
Calamianes Island Group					**South Negros**				
Bugor	28.13	9	48.00	10	Salag	35.83	2	20.30	2
Royukan-Sagrado	21.30	8	56.08	10	Siit/Anduly	34.49	10	17.91	9
Siete Pecados	41.19	10	50.69	10	Tambobo	39.19	2	39.58	3
Average % change			**131.89**		**Average % change**			**-27.64**	
Danajon Reef					**Surigao del Norte**				
Cuaming	11.48	10	8.27	10	Nagubat	34.93	10	16.86	10
Nasingin	7.19	10	8.52	10	San Isidro	11.47	10	10.34	10
Pangapasan	14.76	10	19.63	10	Tagana-an	16.78	10	28.01	10
Average % change			**5.59**		**Average % change**			**5.37**	
Lingayen Gulf					**Sulu Archipelago**				
Alaminos-Telbang	9.62	5	2.42	10	Batubatu-Kulape	14.27	10	29.43	10
Canaoy/Kasay	10.80	9	7.81	10	Tunggusong-Maruwa	34.84	8	65.76	9
Lingsat	21.44	4	20.9	8	Ungos-Ungos	21.16	10	40.03	10
Average % change			**-15.87**		**Average % change**			**97.54**	
San Bernardino Strait					**Verde Island Passage**				
Bulan-Butag	7.00	10	10.82	10	Bagong Silang	14.08	10	19.14	10
Calintaan/Subic	20.36	8	20.38	8	San Teodoro/T Rocks	60.10	8	68.10	8
					Batalang Bato	63.60	9	57.49	8
Average % change			**25.46**		**Average % change**			**11.22**	

Table 46. Weighted average percent change in CPUE and reef fish biomass in the eight MKBAs during the MPA baseline assessment conducted in 2013 and monitoring in 2015 and the estimated percent increase in fisheries biomass.

MKBA		**Average Percent Change**	**Weighing Factor (w_c, w_m)**	**% Increase in Fisheries Biomass**
Calamianes Island Group	Catch Rates	19.71	4786.78	
	Reef Fish Biomass	131.89	2533.28	
Danajon Reef	Catch Rates	1.29	2220.75	
	Reef Fish Biomass	5.59	2159.20	
Lingayen Gulf	Catch Rates	-39.06	3909.16	
	Reef Fish Biomass	-15.87	209.60	
San Bernardino Strait	Catch Rates	-6.13	8125.14	
	Reef Fish Biomass	25.46	986.39	
South Negros Island	Catch Rates	-7.12	11091.02	5.95
	Reef Fish Biomass	-27.64	343.06	
Surigao del Norte and del Sur	Catch Rates	75.96	3781.76	
	Reef Fish Biomass	5.37	817.75	
Sulu Archipelago	Catch Rates	84.03	894.38	
	Reef Fish Biomass	97.54	2761.20	
Verde Island Passage	Catch Rates	-22.36	9150.88	
	Reef Fish Biomass	11.22	539.59	

3.3.2. Measuring Project Result B Using Socio-Economic Assessment Tools

The increase in the number of people gaining employment or better employment will be composed of the following:

a. 10% increase in the number of people gaining employment will be measured through:
   i. number of households with increased fish catch, resulting from the monitoring surveys of 5,000 households across all 8 MKBAs; the hypothesis comes from the FISH project results, wherein the increase in biomass translates into increases in fish catch, therefore increases in fish harvesting-related incomes; fishing incomes are now being monitored through the baseline and monitoring assessments to be conducted in years 1, 3 and 5
   ii. number of households earning additional incomes from project interventions, as a proportion of the total number of households directly invited to participate in project interventions; this is based on the official definition of the indicator under Workforce Development of the USG's List of Standard Indicators:
   Indicator Title: Number of people gaining employment or better employment as a result of participation in USG-funded workforce development programs (Element: EG 6.3 - Workforce Development)
   DEFINITION:
   Number of people gaining employment or better employment within six months of participation in USG funded workforce development programs.
   Better employment is based on the participant's perception of whether the employment is better. (It could be better because it is closer to home, has better pay, a better schedule, etc.)

b. 10% increase in the number of people gaining better employment will be measured through the survey of households, wherein the definition of better employment consists of:
   i. improved seafood consumption, as a proxy of protein intake
   ii. improved awareness/ perceptions on conditions of and threats to marine resources, MPAs, and enforcement activities
   iii. improved household savings or better expenditure patterns
   iv. more fisherfolk using friendlier gears
   v. more fishers with decreased economic costs in fishing, including time travel, distance from shore to fishing grounds

Measurement of the number of people gaining employment from increased profits from fishing (a.i of KPR B), as well as better employment (b.i, b.ii, b.iii and b.v of KPR B) is shown in Table 47.

Table 47. Increase in the number of people gaining employment or better employment in seven MKBAs in 2015 relative to 2013 baseline.

MKBA	ΔE	ΔNet profit	ΔSavings	ΔSeafood diet	ΔEnforcement	ΔMPA awareness and support	Δ Environment perception	ΔLength of fishing trip	ΔTravel time
CIG	22%	13%	-1%	-7%	-42%	-1%	-61%	6%	-4%
DB	16%	-5%	28%	8%	-74%	-53%	-64%	9%	13%
LG	27%	1%	3%	4%	-9%	-20%	-42%	13%	9%
SBTPLG	27%	3%	14%	2%	-4%	-10%	-54%	18%	-5%
SN	22%	39%	-4%	-12%	-60%	-16%	-76%	-1%	11%
SDN	25%	13%	10%	-18%	-4%	0%	-22%	16%	16%
SA									
VIP	55%	5%	6%	-10%	-29%	-7%	-42%	29%	13%
Average	**27%**	**10%**	**8%**	**-5%**	**-32%**	**-15%**	**-52%**	**13%**	**8%**

For the Project Key Result B, the percentage increase (average of the 7 MKBAs) in number of people gaining employment or better employment (ΔE) is 27%. The increase is coming mainly from the improvement in net profits from fishing, shorter fishing trips, shorter travel times to fishing grounds and a general improvement in household savings. There is, however, a significant worsening of perceptions among the sample fishing households. Perceptions on environmental quality, enforcement of fishing regulations and MPA awareness and support had significant declines. Still and all, the combination of all socio-economic indicators show that there is an overall improvement in the number of people gaining employment or better employment in 7 out of 8 project MKBAs.

In the final year of the project, a more in-depth analysis will be conducted using the results of the monitoring surveys. Successes and challenges of project interventions will be qualitatively correlated with the performance of the indicators (i.e. net profits from fishing, fishing patterns, perceptions and general economic indicators), especially on a per MKBA basis. It may not be prudent to conduct statistical correlations given the small size of the project (and the corresponding budget) relative to the entire geographical scope it is working with. Nevertheless, there may be enough anecdotal evidence that may support the results of the monitoring surveys by project end, particularly for partially explaining perceptions on enforcement and MPAs. Furthermore, results of the changes in net profits from fishing will be compared and consolidated with the results of the fish catch monitoring surveys of the project, thus providing stronger evidence on the project's performance in achieving its targets through its interventions.

Results of monitoring of the number of households earning additional incomes from project interventions, as well as fisherfolk using friendlier gears will be reported in Year 5. By then, social enterprises would have been established, or at the very least initiated, and right-sizing of fishing effort would have been implemented across all project sites. This will represent the number of households *gaining employment* from direct project interventions (second component of the indicator, i.e. a.ii of KPR B). In particular, the introduction of economic incentives such as social enterprises for fishing communities, revenue generation schemes for LGUs which will be used for fisheries management interventions, and recognition awards for effective MPAs would have been established in some, or at least initiated in others. Moreover, right-sizing of fishing effort would have been introduced across all project sites. The monitoring data for year 5 will hopefully reflect the impacts of these interventions, particularly resulting to a higher increase in employment or better employment in the project sites. A separate survey will be conducted among the beneficiaries of social enterprise development, but the same instrument will be used.

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